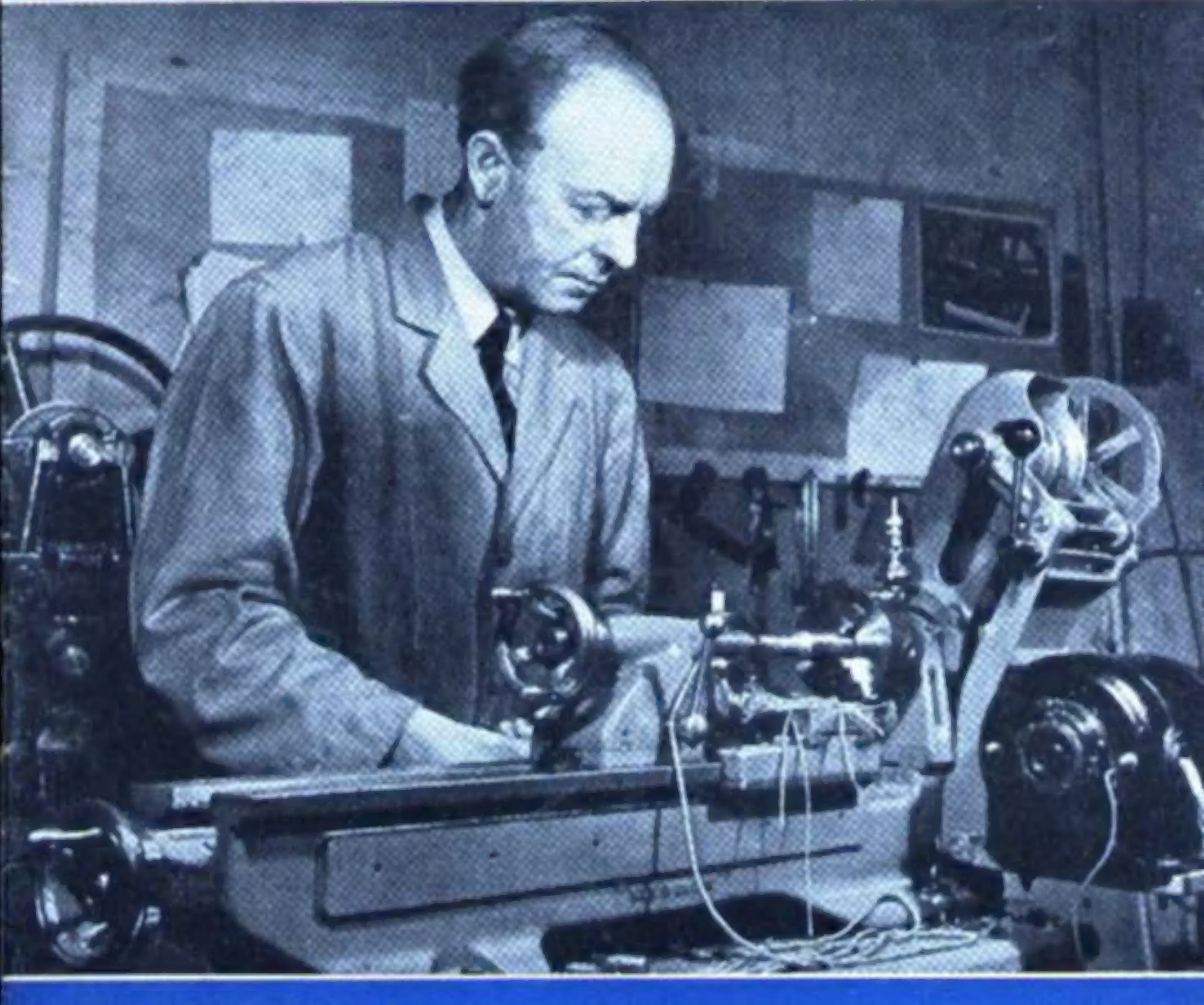
THE MODEL ENGINEER



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THE MODEL ENGINEER

EVERY THURSDAY

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Our Cover Picture

Despite the cramped quarters in the basement of the temporary premises at Great Queen Street, some very useful work was carried out in the "M.E." workshop, under the supervision of Mr. Edgar T. Westbury, assisted by Mr. J. Message who is seen in our cover picture carrying out a machining operation on the Myford M.L.7 lathe. The new offices at Noel Street, which include a large and well-lighted basement, offer excellent conditions for installing a larger and more efficient workshop, the organisation of which is now in progress. The equipment of the workshop has been deliberately planned to simulate, as far as possible, the conditions of the home workshop, as used by many of our readers. There has never been any intention to employ it as a "factory" for the construction of models, its primary function being the working out of practical model engineering problems, the testing of tools and equipment and general experimental work.

SMOKE RINGS

The Right Effect

THERE SEEM to be many model makers who are content to ignore important prototype features in favour of trusting to memory or personal preference, especially when the models are built primarily as working models. We have mentioned this tendency before, and we feel justified in referring to it again, in view of the fact that many people seem to be puzzled by the results of the competitions that take place periodically all over the country.

We would remind readers that one of the most important headings under which models are judged in a competition is "Fidelity," and it is applied in practically all cases, no matter whether the model is a working one, static one, a strictly "scale" model or a "free-lance" effort. The last-named must be so dealt with, if only to prevent a competitor trying to "get away" with flagrant errors just because his model "is not a copy of any particular prototype"! This kind of model is, in all cases, easily detected and is usually deplored; on the other hand, a purely free-lance model which shows careful design in accordance with fundamental prototype principles gains due credit, if not under "Fidelity" then under "Design and Originality." A free-lance model built with due regard for this latter idea nearly always produces the right effect which should be striven for at all costs. In prototype practice, there are always good and sufficient reasons why certain fundamental things are, or are not, done, and a clear understanding of those reasons is essential before a "free-lance" design is attempted.

Urmston's New Secretary

WE HAVE been informed that there has been a change of secretary in the Urmston and District Model Engineering Society. Mr. William Taylor, 31, Hastings Drive, Flixton, near Manchester, now occupies the post, and all future communications should be addressed to him.

Homer Nodding Again

IN A recent issue of *British Railways Magazine*, we came upon a paragraph relating to an employee who is 80 years of age. Good luck to him! We were, however, rather astonished to read the brief account of his history, which contained the following: "Born in 1873, he joined the railway service at 14 on the old *Holland*-Barnsley Railway . . ." The italics are ours, and we do not think they require further comment!

A Satisfied American Subscriber

IN A letter from Mr. Arthur E. Hughes, of Massachusetts, U.S.A., we were pleased to read the following: "In the 1930s, I was on an American steamer running up to London. Having seen and read THE MODEL ENGINEER many times before, I went up to your offices and purchased my subscription. Yet have I to see a magazine of its equal; one is always watching the mail box for that big little 'ours' that comes each week."

Grateful acknowledgments to our American friend. May he enjoy "ours" for many years to come!

Mr. J. Bennett

WE WERE very sorry to learn of the death, on January 24th, of Mr. Jack Bennett, who was a well-known model engineer in Lancashire. He was the founder and president of the Preston and District Model Engineering Society, and was the builder of several fine, successful locomotives, including the ¾-in. scale S.R. "Schools" class engine that won the chief award at the Northern Models Exhibition in Manchester last March. This splendid piece of work was illustrated in the "M.E." for May 29th last.

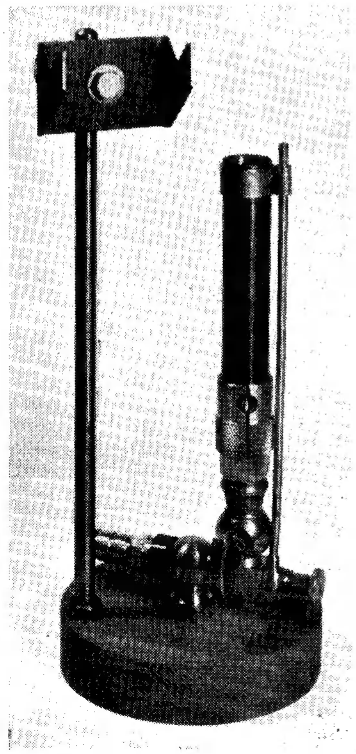
Mr. Bennett was ever ready to lend a helping hand to neighbouring societies and he won respect all over Lancashire and Cheshire. He will be missed by a large circle of friends and acquaintances.

A Bunsen burner for the workshop

Details of a simple, but versatile, heating appliance

By "Ned"

SOME means of producing intense heat, quickly and efficiently, is extremely useful, if not absolutely indispensable, in any workshop; and in cases where a supply of gas is readily available, there is no appliance for this purpose more useful than a Bunsen burner. Among its many advantages over blowlamps and similar burners using liquid fuel, the most important is that it can be lit up instantly, but its convenience and cleanliness, and absence of any maintenance troubles, are also valuable practical assets. The blowlamp, however, has the advantage of being universally portable, by its independence of laid-on facilities, and when maintained in efficient condition, is capable of producing a more intense heat than the simple natural-draught Bunsen burner. But all things considered, and in the majority of cases where heat is required in the workshop, the latter is equal to its task and generally preferred.

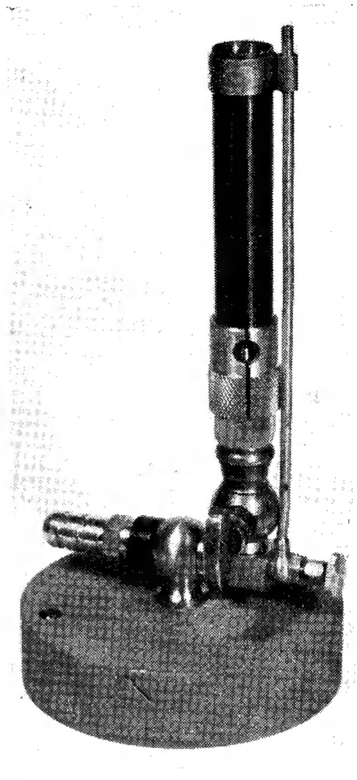


The burner with soldering-bit support attached

In its usual form, a Bunsen burner is one of the simplest devices one could imagine, and is often manufactured very cheaply, or roughly constructed from odds and ends of material by the individual worker who requires one in a hurry. It is possible to adapt an old Welsbach incandescent mantle burner for this purpose in a few minutes. Such makeshifts, primitive as they are, often do all that is required of them, and the amount of gas they consume being relatively small, nobody worries very much whether it is utilised to the best advantage. But it very often happens, when it is very easy to produce a device which will work more or less satisfactorily, that its design is neglected, no consideration being given to the finer points which influence efficiency and economy, or even to making it more convenient and adaptable; and this is the case with the Bunsen burner. There have, however, been many variations and mutations of its original form, such as in the Meker laboratory burner, where provision is made either for working with natural draught, or increasing flame intensity by an additional supply of air under pressure; while gas rings, stove and oven burners are, of course, all adaptations of the same principle.

Principles of Combustion

In the combustion of any kind of fuel, efficiency depends on ensuring that every particle of fuel, at the point where it is ignited, is brought in contact with necessary quantity



The completed workshop Bunsen burner

of oxygen. If this condition is not fulfilled for any reason, combustion will not be complete, some of the fuel being wasted by forming smoke, or fumes of some kind; these usually contain free particles of carbon (soot) and carbon monoxide and other gases, which could, in certain circumstances, be reclaimed and usefully employed, but are of no avail in the initial combustion process. Gaseous fuels are among the easiest of all fuels to burn, as their nature enables them to mix very readily with air, and thereby ensures that atmospheric oxygen is freely intermingled with the gas itself. A very small gas jet, with no special provision for admixture of air, will burn fairly efficiently, especially if it is escaping under pressure; but a larger quantity of gas, escaping at a lower pressure, will tend to burn with a smoky flame, indicating incomplete combustion. This is because the air cannot penetrate the flame column, which then burns only on its surface, as can be proved by introducing a tube into the centre of the flame, when neat gas can be

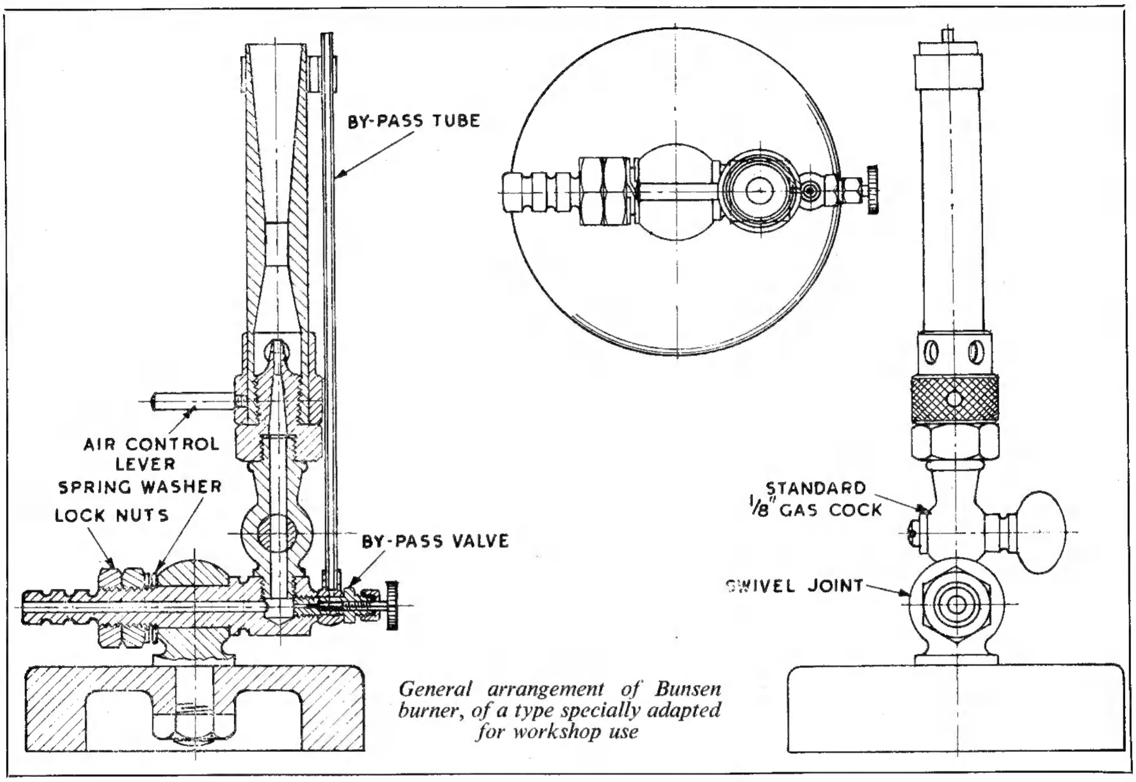
drawn off and ignited at the other end of the tube.

Injector Effect

The Bunsen burner enables a relatively large quantity of gas to be efficiently consumed, by mixing air with it before it arrives at the mouth of the burner, where it is ignited. This is done by utilising the small amount of pressure in the gas supply mains to operate as an injector, thereby drawing air into the lower end of the mixing tube and mingling it intimately with the gas. So long as a substantial velocity of the gas-air mixture can be maintained, it will burn only at the top of the tube, but if the velocity of the mixture is reduced by lowering gas pressure, or if the proportion of gas in relation to air is too small, the flame will pass down the tube and "light back" at the jet nozzle. It follows, therefore, that the more efficient the design of the injector, the higher will be the mixture velocity, and the better the mixing of the gas and air, so that the burner will not only be more efficient at its maximum capacity, but also more controllable, enabling the size and intensity of the flame to be reduced when desired.

Limits of Size

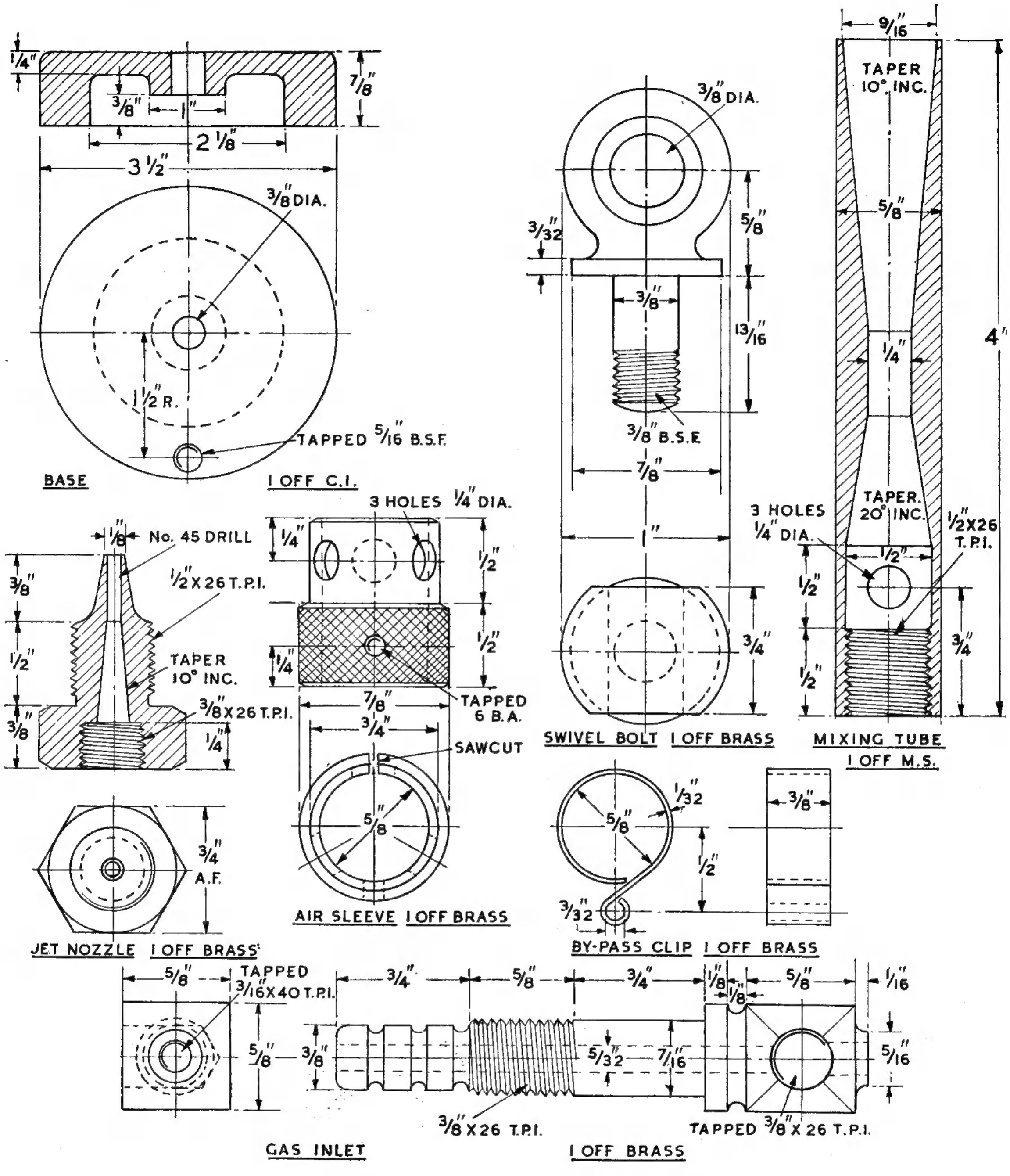
The normal single-tube type of burner cannot be made of unlimited size, as the flame, even in this case, is only superficial ; it is not usual to make burners of this type more than about ¾ in. in tube diameter, unless either the gas or air is supplied under pressure. Multiple-jet burners, however, or plain burners with flame diffusers, can be designed to burn larger quantities of gas, even with only one gas nozzle and mixing tube. The usual and possibly the most efficient arrangement of the plain burner is with the tube vertical, as in this case, the gas, being lighter than air, tends to augment the upward flow velocity slightly ; but a burner of good design will work in any position. Any interference with the burner outlet, by the use of a diffuser or multiple jets, lowers flame intensity to some extent, but not necessarily efficiency, in the sense of the actual amount of heat produced for a given quantity of gas consumed. Noise does not necessarily indicate efficient combustion ; it may indicate a bad design of burner, coupled with weak mixture. Further, excess of air may cause rapid pulsation of the flame, and eventually "lighting back" at the gas jet. In this and in other respects, the superiority of a well-designed burner shows up under practical working conditions.



General arrangement of Bunsen burner, of a type specially adapted for workshop use

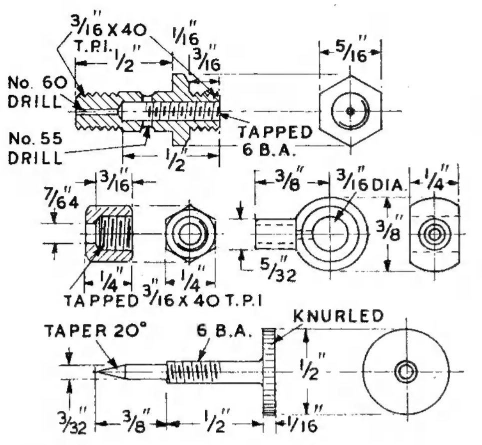
Construction of a Workshop Burner

The burner shown in the illustrations is not claimed to be the last word in appliances of this type, in respect of either efficiency or economy, but it has certain features which have been found by test to be useful and convenient ; it was evolved as a result of experience with ready-made and home-made burners, in which their limitations and faults were shown up. One ready-made burner had a base which was too small and light, so that it would fall over at the least provocation, or even with the weight of the supply pipe ; so I decided to use a broad and heavy base in this one, and an old flywheel which happened to be handy served the purpose quite well. The burner often had to be propped up at an angle to direct the flame on



to some job or other, and it was sometimes found necessary to jury-rig some form of stand or prop to support a soldering bit or other object to be heated ; so these eventualities were provided for in the design. As one does not usually find it convenient to keep the burner going continuously at full blast, yet the need for frequently relighting it is undesirable, the provision of a by-pass jet is an obvious advantage.

Details of the burner components are given in the drawings, and it will be seen that these are all of a fairly simple nature ; in fact, it may be said that it took me longer to make these drawings than to construct the actual burner. Some of the details are obviously capable of variation to suit the materials or



BY-PASS VALVE DETAILS 1 OFF EACH BRASS

facilities available, but those which concern the functioning of the burner should be made to coincide as closely with the drawings as possible. It will be seen that there are one or two discrepancies between the latter and the burner seen in the photographs, as some detail improvements have been incorporated when making the drawings.

Base

Quite a lot of latitude in shape and dimensions is possible here; within reason, the larger and heavier the better. It could be made a good deal more handsome than it is as shown, but for a reason which will be apparent later, it is desirable to make the top surface flat for all or most of its diameter. Machining is optional, as a rough casting merely having the centre hole drilled and faced, and afterwards painted, would serve its purpose quite satisfactorily.

Swivel Bolt

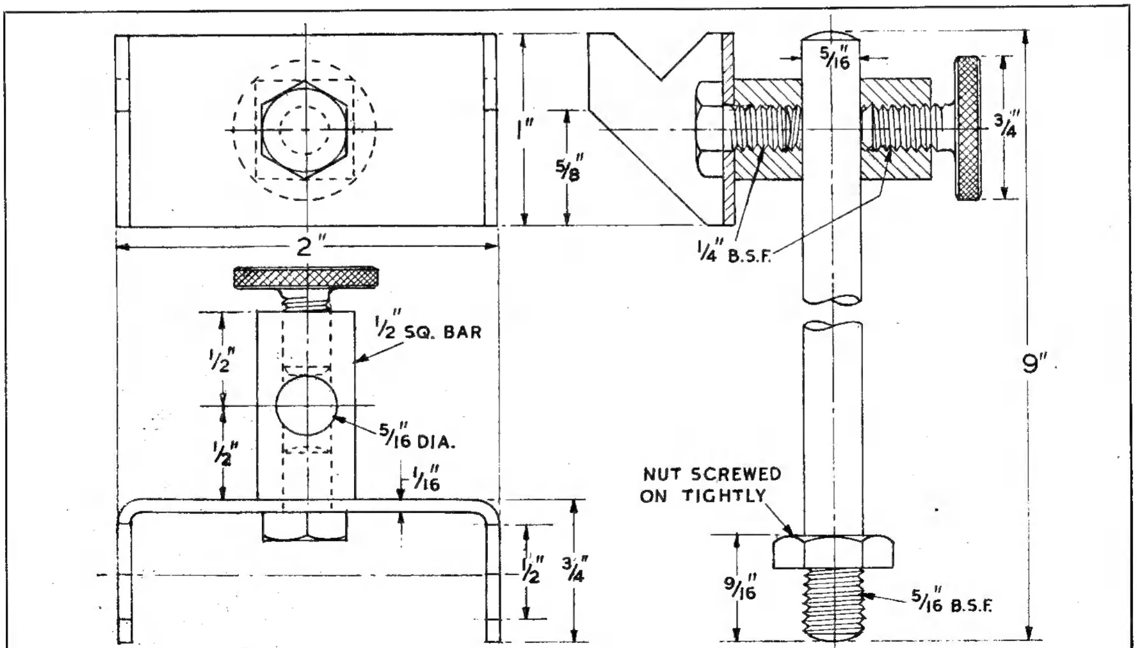
This was turned all over from an odd piece of brass rod, but other materials are equally suitable; the shank was turned first, and the thread cut with a tailstock die-holder, the spherical top being roughed out as far as accessible before reversing the job for finishing it to shape. This may be carried out with the aid of a simple ball turning appliance, such as that described in connection with the " M.E." universal vice, in the issue of the " M.E." dated May 12th, 1949. Hand turning is, however, permissible if care is taken to get the shape as true as possible, using a radius gauge as a guide, if available.

The work is then mounted at right-angles to its axis, either in the chuck, or by bolting it through one of the slots of an angle-plate mounted on the faceplate. In order to set it truly for boring through the centre, it should first be roughly set up by eye, and a light facing cut taken, producing a small circular facet which can be marked and centre-punched, as a guide for more accurate setting. The exact width, or rather the axial length of the bore, is not important, but the two ends should be faced truly with the axis, and symmetrically to the centre of the head.

A thin nut is fitted to the screwed shank to secure the bolt in place when fitted to the base, and care should be taken to see that neither the nut nor the end of the bolt stands proud of the base rim.

Gas Inlet

Either a piece of $\frac{5}{8}$ in. square stock may be used for turning this from the solid, or a short piece of this material may be brazed, sweated or screwed on to a round shank of suitable diameter. The shank is turned to the dimensions shown, the head being left $\frac{5}{8}$ in. square, for a length of $\frac{3}{8}$ in., and necked down behind this, with a circular collar left as near the full diameter as possible, to take the frictional thrust where it fits against the side



SOLDERING BIT SUPPORT 1 OFF M.S.

of the swivel bolt. At the extreme end, the shank is turned to $\frac{3}{8}$ in. diameter, bevelled or rounded at the tip, and grooved to take the flexible pipe connection. The thread specified on this component is brass pipe standard, but any suitable *fine* thread may be used. Finally, the shank should be drilled 5/32 in. diameter right up the centre, but it is advisable not to take this right through the head until the cross hole is drilled and tapped, as it may tend to cause the latter to wander out of truth. The job can be reversed and held in the chuck for facing the head, and tapping the hole for the bypass valve.

Swivel Adjustment

When this part is assembled, it should have a double-turn spring washer and two thin lock-nuts fitted, as shown on the general arrangement drawing, and adjusted up so that it will swivel stiffly in the head of the bolt. It will be seen that this causes the gas supply pipe to twist through a maximum of $\frac{1}{4}$ turn, but this has not been found to do any harm when using either rubber or metallic supply tubing.

The cross hole for the gas cock is specified as $\frac{3}{8}$ in. × 26 t.p.i. (brass pipe standard), but this fitting will depend on the gas cock used, and sometimes the cock may be found to be screwed $\frac{1}{8}$ in. gas thread, which is 28 t.p.i., and a little over $\frac{3}{8}$ in. outside dia. (Incidentally, it may be noted that gas pipe threads are rated on the nominal *inside* diameter of the pipes to which the fittings are intended to be applied.) It may, therefore, be necessary to modify the thread dimensions, both in this component, and also that which is next described. The gas cock used was one of the cheapest commercial type, but is quite satisfactory for its purpose ; a more handsome one, or possibly one incorporating a bypass, could be obtained if desired.

Jet Nozzle

This was machined from hexagonal brass bar, the lower end being faced, centre-drilled and drilled, first with a pilot drill, then counter-drilled to tapping size. The size of jet orifice required may vary according to the mains gas pressure in different localities ; the size shown was satisfactory in my case, but it may be found desirable to make it smaller, and adjust it by broaching or opening out with one size larger drill at a time, until the burner will take full air, and does not tend to light back. A D-bit was used to taper the bore below the orifice, the object of this being to avoid an abrupt change of diameter here, which would cause turbulence and lower the gas velocity at the nozzle outlet.

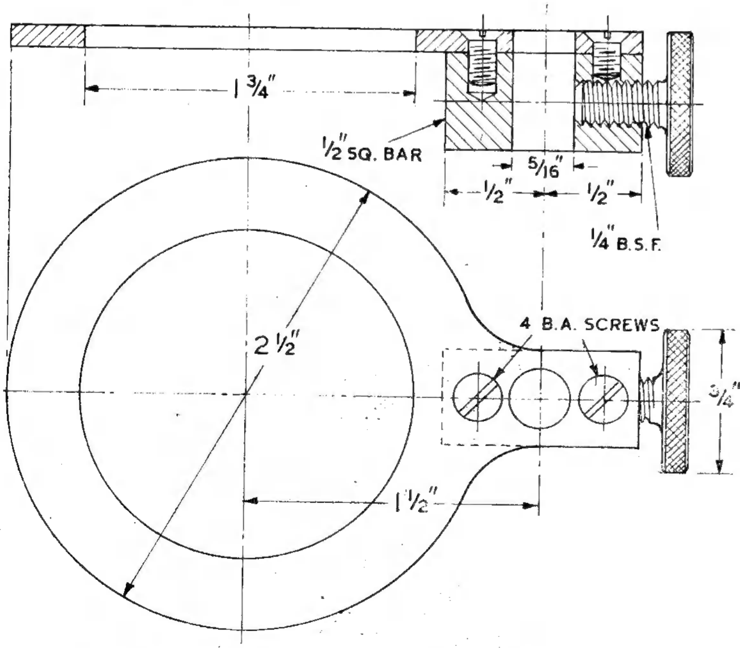
On the outside, this part can be roughed down almost to size at the same setting and then parted off, afterwards being finished by mounting on a stub held in the chuck and turned and screwed in position, so that true running is assured. It is screwed $\frac{1}{2}$ in. brass pipe thread, with an undercut at the shoulder to allow the mixing tube to screw right home and the tip of the nozzle is shaped so as to avoid any obstruction of air flow around it.

Mixing Tube

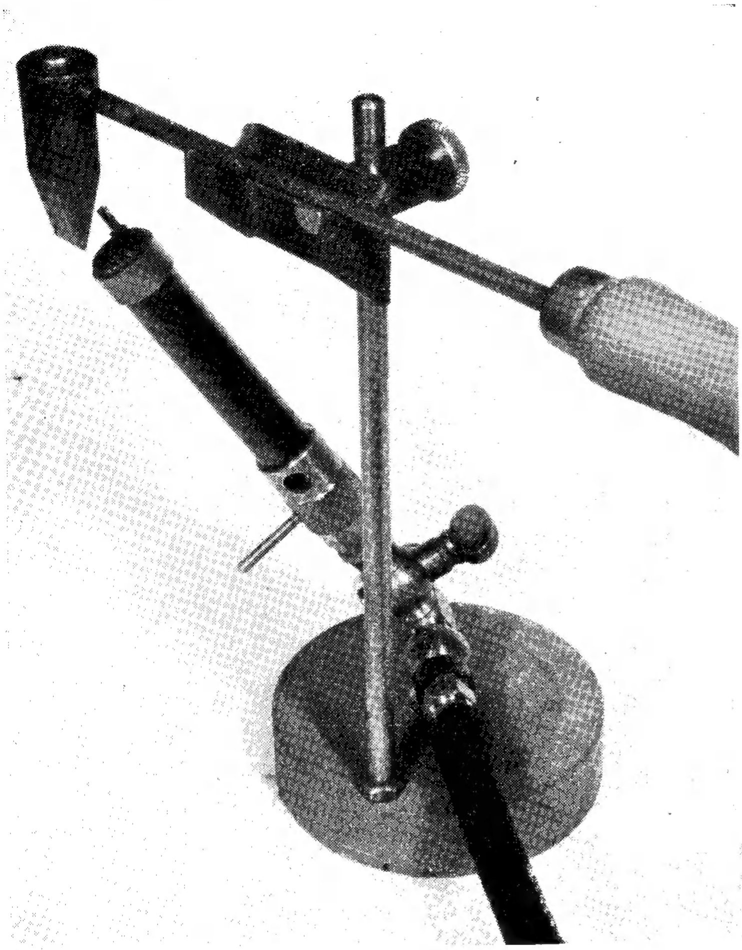
A piece of $\frac{5}{8}$ in. diameter mild-steel rod was used for this part, and required only to be faced, drilled, bored, and tapped. The internal shape is designed to produce the maximum injector efficiency, and although it might be thought that the small bore in the centre would cause restriction, it has, in fact, a high discharge coefficient, and will pass as much air as a plain parallel tube of nearly twice the cross-sectional area. At the upper end, the taper is designed so that if the lines of its sides were extended, they would meet at an apex in the jet nozzle. The lower taper is of less importance, and the lengths of both tapers, also of the parallel throat, are not specified, as they could not be measured with any degree of accuracy. Axial and concentric alignment of the bore, and also the thread at the lower end, should be maintained as accurately as possible. The bore immediately above the screwed part is chambered out to approximately the crest diameter of the thread ; all the boring was done by means of a tool made from $\frac{1}{4}$ in. dia. silver-steel, turned taper at the end and bent round, then ground to shape, hardened and tempered.

Air Sleeve

This was made from $\frac{3}{4}$ in. diameter brass, bored to a tight fit on the outside of the mixing tube, and machined down to $\frac{5}{8}$ in. diameter for half its length. The knurling is optional, as it has no actual function if the extended lever is fitted as shown, but it improves appearance. While in place on the tube, three small pilot holes, equally spaced, should be drilled through both sleeve and tube ; the parts are then separated, and the holes opened out to full size, external and internal burrs being removed. A 6-B.A. hole is drilled and tapped in the lower part of the sleeve for the lever, which is made from a piece of $\frac{1}{8}$ in. brass rod, $\frac{7}{8}$ in. long, turned about 15 " thou." smaller for a length of $\frac{1}{8}$ in., and screwed 6 B.A. to fit *tightly* in the hole, any projection inside the sleeve being filed flush.



ALTERNATIVE SUPPORT 1 OFF M.S.



Using the burner in the inclined position for heating a hatchet-shaped bit

The sleeve is then sawn right through across the hole opposite to the adjusting lever, to give it sufficient spring to rotate frictionally on the tube.

Bypass Valve

It would be quite practicable to form this integral with the gas inlet body, but for several reasons it was decided to make it as a separate component. Some types of bypass burners are not provided with a valve at all, but have a capillary jet nipple (sometimes formed by hammering the end of the pipe nearly flat !) but the ability to adjust the bypass flame is often useful. The parts for the valve are shown here in detail, and are not difficult to produce, but call for some care and delicacy in handling. Spherical turning is called for in the case of the " banjo " union, which can be dealt with in much the same way as the swivel bolt, but on a much smaller scale. The valve body should be turned and screwed at the inner end first, then fitted to a stub, held in the chuck and drilled and tapped *in situ*, to ensure truth in the centre hole and the thread for the gland nut. To locate the cross hole correctly, the valve may be assembled and the banjo secured in position, the drill then being run through the latter into the valve body.

The screwed spindle should preferably be made from solid $\frac{1}{8}$ in. dia. stock, the end portion being first turned down and pointed before reducing the rest of the shank to size, thus avoiding the excessive spring which would occur in trying to turn the full length at once. For packing the gland, a short piece of small plastic sleeving will be found suitable. A length of 3/32 in. copper pipe, long enough to reach just above the top of the mixing tube, is sweated into the banjo, and the pipe is clipped to the tube by a simple bent clip of 1/32 in. or 20-gauge sheet or strip brass.

Burner Attachments

When the burner is used for the purpose of heating a soldering bit, some means of supporting the latter must be provided, and when the stability of the base is adequate, it is convenient to attach the support to the burner, rather than making it a separate unit. Sometimes a support is arranged to clip on to the burner tube, but in this case I have considered it better to provide a pillar which can, when occasion requires, be screwed into the base, as near the outer rim as possible, with an adjustable bracket clamped to it. The actual support is made from sheet steel, bent to shape, with vee notches in which the shank of the bit will rest, and in the size shown, will support bits up to about 1 lb. weight. In this particular application, it is often found that the tilting movement of the burner is very useful, such as when heating hatchet-shaped bits, as it enables the flame to play on the side of the bit, rather than on the tip, which is obviously undesirable.

When soldering operations are in progress, it often happens that the bit is out of use for several minutes at a time, but still must be kept hot, and ready for instant use. In such cases, it is possible to adjust the bypass flame so that it will just maintain the temperature, and the risk of overheating the bit during prolonged inactive periods is thereby avoided ; the main burner only needs to be used after the bit has been cooled off in use, and needs to be reheated.

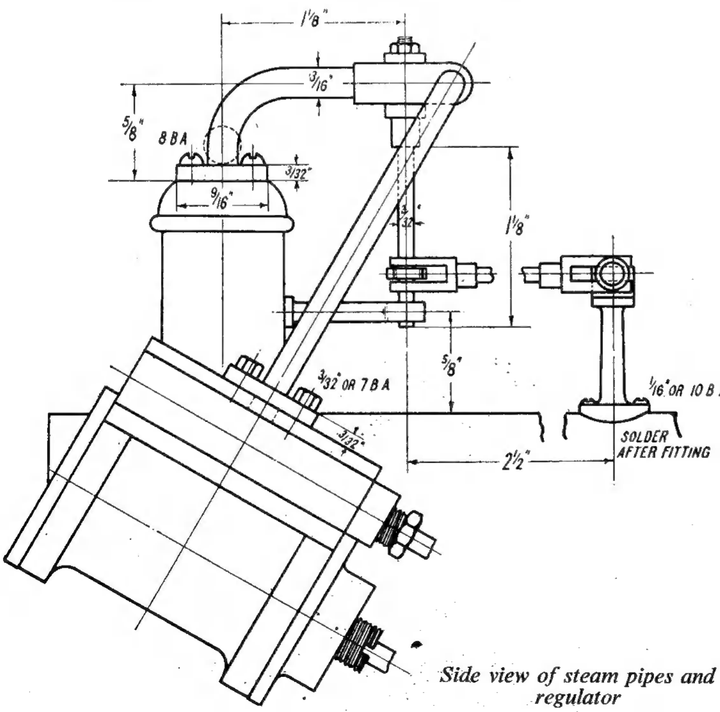
For heating vessels such as salt baths, plumbers' ladles, or glue-pots, a small gas ring is preferable to a Bunsen burner, as the height of the latter is an obvious disadvantage. Laboratory workers, however, often use a Bunsen tripod for supporting flasks, sand baths, etc., over the burner, and a substitute for this, if the vessel is not too heavy, may be found in the adjustable support ring shown in the drawing, which also fits the vertical column.

The burner, in the inclined or horizontal position, has advantages for such purposes as glass-blowing and light brazing. Finally, it may be mentioned that the pilot light is undoubtedly a boon to smokers !

L.B.S.C.'s "Canterbury Lamb" in 3½ in. Gauge

●STEAM PIPES AND REGULATOR

THE steam pipes and regulator for the little " old iron " form about the most comical arrangement that I have ever schemed out. Naturally, we indulge in a laugh at the crude efforts of the early locomotive engineers, but it must be borne in mind that they were kind of groping in the dark, with no experience to fall back upon, and the only way they could achieve anything at all, was by trial and error ; so all credit be to them for what they managed to do. Had it not been for their perseverance, there would have been no " Britannias " scorching the ballast between Liverpool Street and Norwich today. At the same time, they apparently didn't always use their thinking apparatus to the best advantage ; otherwise the merchant responsible for the plumbing arrangements on *Invicta* would have realised that such a vast expanse of exposed steam pipes wasn't going to improve the general efficiency of the whole bag of tricks. There were several alternatives which might have been used. However, the old girl had the arrangement very much as it is shown in the accompanying illustrations ; and as she has an efficient superheater, the little edition won't worry much about heat losses due to exposed piping. I have substituted a plain plug cock for the weird and wonderful regulator gadget on not-so-big sister. I don't like plug cocks, owing to their tendency to be everlastingly trying to stick and leak ; but in the present instance, there shouldn't be any sticking, nor leaking either, as the oil from the mechanical lubricator comes in at the top of the dome, where the steam pipe emerges, and the whole blessed lot has to pass through the regulator, so that it should never become dry. The complete pipe assembly, and the regulator itself, is built up as a single unit, and can be removed bodily, if required, by taking the screws out of the flange joints, and disconnecting the fork on the regulator-rod.



Side view of steam pipes and regulator

Regulator Valve

The regulator valve—tell it not in Gath !—is practically the same as was fitted to my five-shilling tin *Ajax* of sixty-odd years ago. On that apology for a locomotive, it was arranged vertically below frame level, just behind the boiler ; the steam pipe went up inside the boiler, the cross pipe was straight, and went to the oscillating cylinders at each side, and the cock handle projected up through a slot in the footplate. The cock body was a little brass casting, and it may be so in the present instance ; or it may be cut from a piece of good quality brass or gunmetal, ¾ in. long, 7/16 in. wide and ¼ in. thick, to the shape shown in the illustration. At ⅛ in. from the longer end, drill a cross hole with No. 23 drill. Next drill a ⅛ in. hole from the opposite end, into the cross hole ; the easiest way of doing this accurately, is to hold the longer end in the four-jaw, setting the piece to run truly, Centre the end, and drill with a ⅛-in. or No. 31 held in three-jaw. Open out the end for ⅛ in. depth, with a No. 14 drill. Finally, drill a 15/64-in. hole through the middle of the bulge, at right-angles to the axis of the cross-hole.

No Worry

Most amateurs, especially beginners, have the dickens' own job to turn a taper plug to fit accurately in a taper hole. In the present instance they don't have to worry in the slightest. Chuck a bit of 5/16-in. round silver-steel in the three-jaw, and turn a taper on it, until the end has been reduced to 7/32 in. diameter. If the top slide is set over to 3 deg. the angle will be about right. If your top slide isn't graduated, set it as near as you can to the angle shown in the illustration, as the exact degree of taper doesn't matter. File away half the diameter of the tapered part, harden and temper it exactly as described for injector reamers and so on, and then proceed to ream the hole in the cock body, by aid of a tap-wrench on the reamer shank. Warning—don't let the reamer cut a taper to the full depth of the hole ; leave about 1/16 in. parallel, to allow for grinding-in and adjusting the cock plug.

Now, before resetting the slide

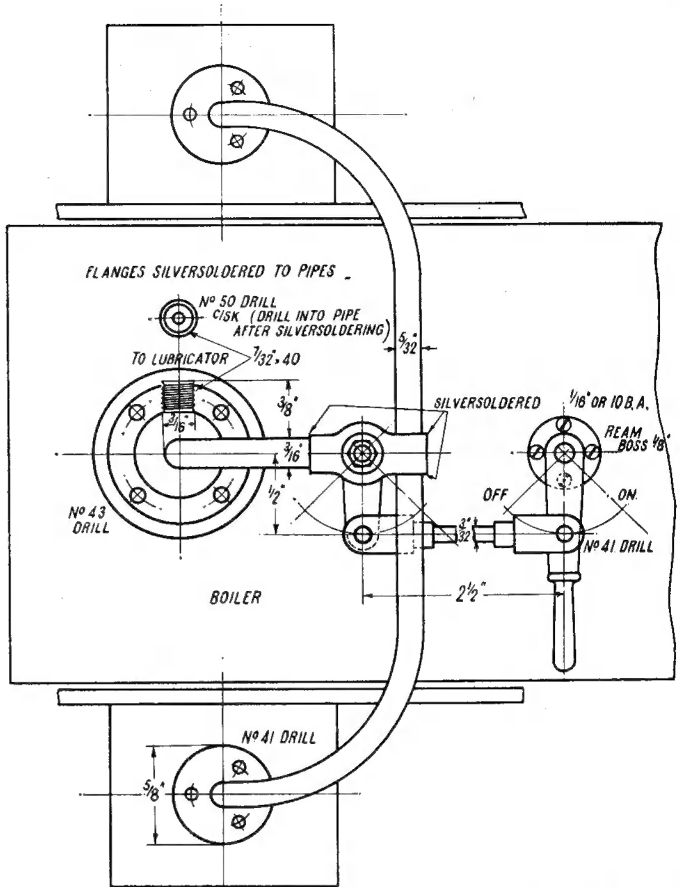
back to its normal parallel setting, and without making any alteration to the setting of the tool—both points very important—chuck a piece of 9/32-in. or $\frac{5}{16}$-in. round bronze or gunmetal rod, and turn a taper on each end, similar to that on the reamer. If you turn two tapers, there will be a spare, in case the first one is spoilt. The slide can then be set parallel again, and one of the ends of the tapered rod turned to $\frac{3}{16}$ in. diameter, for such a length that when the cock body is tried on it, the tapered part just won't come through by about 1/32 in. as shown in the sectional illustration. Further reduce the end to 3/32 in., until within about 5/64 in. of the taper, thus leaving a wee bit of $\frac{3}{16}$-in. between shoulders. Screw the small end 3/32 in. or 7 B.A., then file the intermediate bit square, using one of the chuck jaws as a guide, as fully described in the *Tich* instructions. Part off at a full $\frac{1}{2}$ in. from the shoulder ; and it wouldn't be a bad wheeze to ditto repeato operations on the other tapered end—just in case ! As my one and only niece used to say in her schoolgirl days, "One never knows, does one ?"

Finishing the Plugs

To do this, chuck any odd scrap of brass rod in three-jaw, something about $\frac{1}{2}$ in. long and $\frac{1}{2}$ in. diameter. Face, centre, drill through with 15/64-in. drill, and ream with the taper reamer used for the cock body. If the plug is pushed tightly into the hole, it should fit like the lathe centre, and the end can be faced off, centred, drilled No. 48 for about $\frac{3}{16}$ in. down, and tapped 3/32 in. or 7 B.A. Turn $\frac{3}{16}$ in. of the outside to $\frac{3}{16}$ in. diameter. Chuck the $\frac{5}{16}$-in. rod again ; face, centre, drill down about $\frac{1}{4}$ in. with 5/32 in. drill, chamfer the edge, and part off two $\frac{1}{16}$-in. slices, chamfering the edge of the second one before parting off. File the holes square, to fit the square on the plug. If the two plugs are finished, you have a spare, which may come in handy. Don't fit the plug permanently, or do any grinding-in, until the pipes have been silver-soldered to the body ; just put the plug tightly in place, and run the $\frac{1}{8}$-in. drill through it, via the hole in the cock body.

Steam Pipes

For the dome flange, chuck a piece of $\frac{5}{8}$-in. round brass rod, face, centre, drill down a full $\frac{1}{8}$ in. with No. 14 drill, turn down $\frac{1}{8}$ in. length to $\frac{9}{16}$ in. diameter, and part off a 3/32 in. slice. The bend in the steam pipe can be easily made by bending



Plan of regulator and steam pipes

the end of a longer piece of pipe than actually needed, and cutting off the bent end to required length. One end is fitted to the regulator body ; and the flange is drilled for the screws, and fitted to the other end, any burrs being filed off. Stand the assembly temporarily on the dome ; and with a bit of soft copper wire, or thick lead fuse wire, measure from the cross hole to the hole in the middle of the steamchest cover. Bend the wire into a nice sweeping curve, as shown ; cut it to length, remove the assembly, straighten out the measuring wire, cut two pieces of 5/32-in. copper tube to same length, and fit them to the cross hole in the regulator body. The flanges are made from $\frac{5}{8}$-in. round rod, as described for the dome flange above. The holes for the pipes are drilled No. 23, and the screwholes No. 41.

As mentioned above, the oil supply from the mechanical lubricator is fed into the main steam pipe just above the dome, whence the rush of steam carries it to the cylinders. Chuck a bit of $\frac{1}{4}$-in. round brass rod, turn down a full $\frac{1}{2}$ in. length to 7/32 in. diameter, and further reduce $\frac{1}{4}$ in. of the end, to $\frac{3}{16}$ in. diameter. Part off at $\frac{1}{2}$ in. from the end. Reverse in chuck, screw the outside 7/32 in. × 40, centre deeply, and drill right through with 3/32-in. or No. 41 drill. Scallop out the plain end with a $\frac{3}{16}$-in. round file, until it beds nicely on the steam pipe ; then tie it in place with a bit of iron binding wire, just above the dome flange. The whole of the joints can then be silver-soldered at one heating ; pickle, wash off, and clean up. Let the water run through until all the scale and other residue is washed out of the pipes. Run a 3/32-in. drill through the lubricator connection into the steam pipe.

The assembly can now be tem-

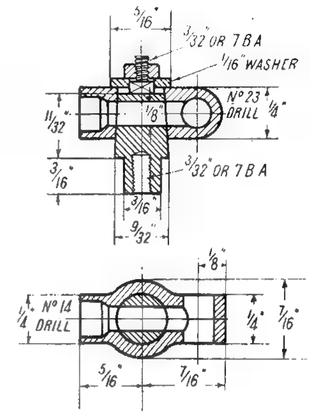
porarily erected, the holes for the screws being located in the dome top and steamchest covers, through the holes in the flanges, in the same way that I have often described for fitting cylinder covers. See that the pipes have nice even bends, without any kinking or flattening, as they are very prominent. Next, cut a $1\frac{1}{4}$ in. length of 3/32-in. round steel (mild or silver), screw one end 3/32 in. or 7 B.A. for $\frac{1}{8}$ in. length, and screw tightly into the boss of the regulator plug; it would be as well to silver-solder it, in case it slips. Grind the plug into the taper hole in the body, by smearing just a taste of emery, or a scraping off your oilstone, on the plug, and twirling lightly back and forth with your fingers; pumice powder

spindle. After cleaning up, clean the plug and taper hole, smear with cylinder oil, fit the plug, and put on the square-holed washer and nut.

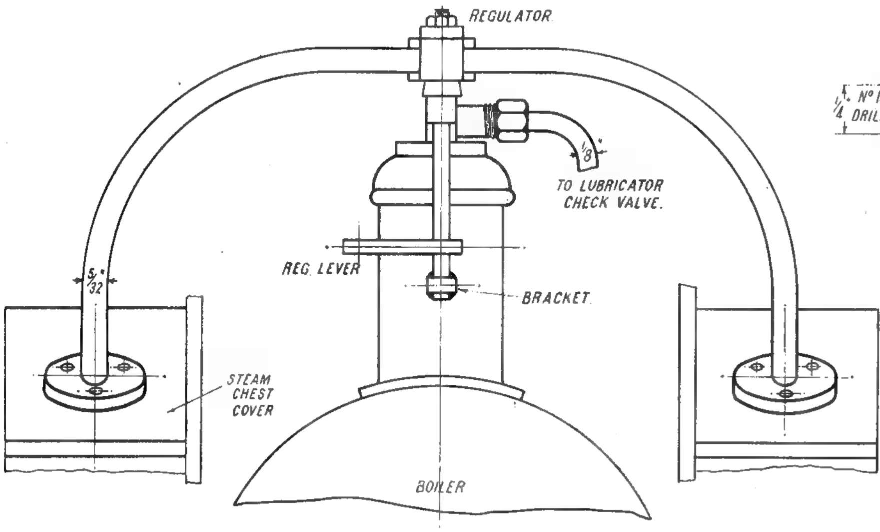
Bracket for Regulator Spindle

The long thin spindle would naturally buckle if unsupported at its lower end; and the old lady of the market-place had a support for hers, fixed to the dome, so we can follow her good example. It is shown in the detail illustration, and can easily be turned from a piece of $\frac{3}{16}$ in. square mild steel. Chuck truly in four-jaw, face the end, and turn down $\frac{3}{16}$ in. length to 3/32 in. diameter; screw 3/32 in. or 7 B.A. Turn the next $\frac{1}{8}$ in. or so, to $\frac{3}{16}$ in. diameter, then turn a full $\frac{1}{2}$ in. length to $\frac{1}{8}$ in. diameter,

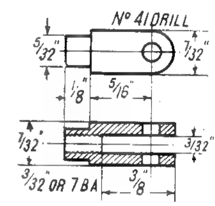
tube, the stem can easily be nutted on the inside. Slightly round the flat face of the nut, to match the curve of the dome; remove cover, drill the hole in the side of dome with No. 41 drill, push the screwed spigot of the bracket through, and screw it into the nut. Did I hear an SOS from beginners, asking how on earth they were going to hold the nut opposite the spigot



Regulator valve



Back view of steampipe assembly



Fork for regulator- rod

and water also does the trick—we used it on the old Brighton engines, for water-gauge cocks, and blower and donkey-pump steam valves. Only a very little grinding is necessary as the plug will fit the hole exactly if made as described above. Don't fit the washer and nut yet.

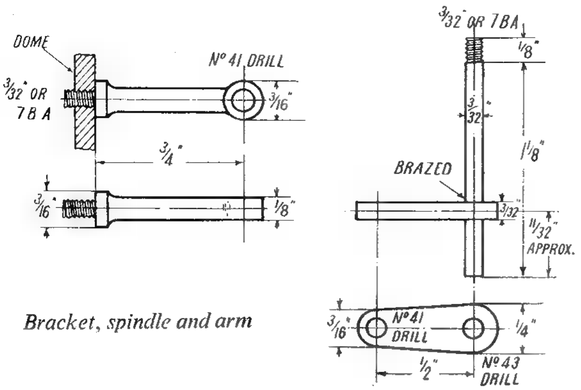
Next, cut out the little arm that fits on the lower part of the spindle, from a piece of 3/32-in. × $\frac{1}{4}$-in flat steel; a simple filing and drilling job. Mount it on the spindle at $1\frac{1}{16}$ in. (measured from centre) below the underside of the regulator body, with the plug temporarily in place. Adjust the angle, so that when the cock is fully open, the arm is at an angle of 45 deg., as shown by the line marked "on" in the plan of the assembly. The arm can then be silver-soldered or brazed to the

leaving the rounded flange $\frac{1}{16}$ in. thick. Part off at $\frac{7}{8}$ in. from the end; then, at $\frac{3}{4}$ in. from the shoulder, drill a No. 41 hole. and file the end, around the hole, to the shape of an eye, as shown in the illustration. This sounds like Pat's antic of building a barrel around a bunghole! The eye should be $\frac{3}{16}$ in. diameter and $\frac{1}{8}$ in. thick.

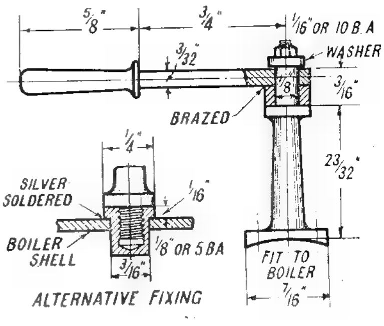
At $\frac{5}{8}$ in. above the top of the boiler, and exactly above the centre-line, drill a No. 48 hole in the dome and tap it 3/32 in. or 7 B.A., to match the spigot of the bracket, which can then be screwed in. The eye should be horizontal, as shown, when the bracket is screwed right home. If the dome is made from a casting, there should be enough thickness of metal to provide plenty of hold for the thread. If, however, the wall of the dome is thin, or if made from

halfway down the dome? Bless your hearts and souls, you don't even need a pair of watchmaker's tweezers, though they are useful for that sort of lark. Cut a strip of thin card (bit of a postcard will do) put a tiny blob of anything sticky on the bottom (Seccotine, or something similar; I've used condensed milk before now!) stick the weeny nut on it, hold it opposite the spigot, screw home, and pull the bit of card away. Replace cover, and Bob's your uncle once more.

The whole steam pipe assembly can then be permanently erected. Cut gaskets of 1/64-in. Hallite or similar jointing, to go under each flange, and don't forget the holes in the middle, to let the steam through. Drop the assembly into place, with the regulator spindle passing through the bracket, as shown in the eleva-



Bracket, spindle and arm



Regulator handle and pillar

tion drawing. The flange on top of the dome is fixed down by four 8-B.A. round-head brass screws. Hexagon screws won't clear the steam pipe here, unless you make your own, with extra small heads, as recently described. There is, however, plenty of room for hexagon heads around the flanges of the two side steam pipes, so please yourselves what kind of noddles you use in those flanges. When all the screws are tightened, the assembly should be quite firm, and the regulator valve should move easily when the arm on the vertical spindle is moved back and forth. No stops are needed, any more than on an ordinary cock; the position of the handle will be sufficient indication of "on" and "off" positions.

It only remains to connect the nipple above the dome flange, with its mate on the check valve underneath the mechanical lubricator, and this is done by a piece of $\frac{1}{8}$-in., or thin-walled 3/32-in. copper pipe, with a 7/32-in. × 40 union nut and cone on each end. It doesn't matter a Whitstable oyster, where you run the pipe; as good a plan as any, would be to bring the pipe from under the lubricator, out between boiler and frame, and take it up by the right-hand cylinder, close to the frame. Just make the bends look neat; they will be neater, anyway, than the feed-pipe arrangement which adorns the rear end of the old girl herself!

Regulator Handle

The regulator handle can be cut from the solid or built up. For those who are more fond of work than Curly is, chuck a piece of $\frac{1}{4}$-in. square steel in the four-jaw, a little off centre, and turn the grip; then saw and file, or mill away the surplus, leaving the flat part of the handle as shown. The boss can be hand-filed, and is drilled No. 32 and reamed $\frac{1}{8}$ in. To build up, turn the grip from a bit of $\frac{3}{16}$-in. round mild steel, and file up the flat part from $\frac{1}{4}$-in. × 3/32-in. strip. Drill a $\frac{1}{16}$-in. hole in the end of the grip, and file or turn a pip on the flat part, to fit it tightly, and hold it whilst brazing. Rivet a 3/32-in. × $\frac{1}{4}$-in. steel washer on the wide end, with a $\frac{1}{16}$-in. iron rivet, then braze the joints. After cleaning up, chuck the washer in the three-jaw, with the flat part of the handle against the other jaws; centre, drill No. 32, and ream $\frac{1}{8}$ in.

The Pillar

The pillar is turned from $\frac{7}{16}$-in. round mild-steel held in three-jaw. Turn down a bare $\frac{3}{8}$ in. length to $\frac{1}{8}$ in. diameter, a nice fit in the boss of the handle. Further reduce the end to $\frac{1}{16}$ in., leaving a full $\frac{3}{16}$ in. of $\frac{1}{8}$ in. diameter between the shoulders. Screw $\frac{1}{16}$ in. or 10 B.A.; turn the rest of the pillar to size and shape shown, and part off at a bare $\frac{13}{16}$ in. from the shoulder. Radius out the base as shown, with a half-round file, to fit the boiler shell. Drill four No. 51 holes in the flange, attach it to the boiler shell by four $\frac{1}{16}$-in. or 10-B.A. brass screws, at $2\frac{1}{2}$ in. behind the regulator spindle, and sweat all around the flange and over the screwheads, to prevent any chance of leakage. Make certain that the pillar is exactly on the boiler centre-line.

Those good folk who have not yet made the boiler, may—if they so desire—silver-solder a "blind" bush, tapped $\frac{1}{8}$ in. or 5 B.A., into the boiler shell, at the point where the pillar stands. The latter may then be turned from $\frac{1}{4}$-in. round rod, with a screwed spigot at the bottom, to fit the bush, into which it is screwed tightly.

Drill a No. 41 hole in the regulator handle at $\frac{1}{2}$ in. from boss centre, put the boss over the top of the pillar, so that it rests on the shoulder as shown, and secure with a large washer and a nut. When the nut is tight, the lever should be quite free to swing. Now make two forks, to the given sizes; they are the same as valve-gear forks, so instructions need not be repeated. Join them by a piece of 3/32-in. silver-steel screwed at each end; the distance between eyes should be $2\frac{1}{2}$ in., but check off from the actual job, in case of any inadvertent error in erecting the pillar. Handle and spindle-arm should be parallel. Attach forks to arm and handle, by 3/32-in. bolts made from 3/32-in. round steel screwed and nutted at both ends; and the regulator valve should work quite freely when the handle is moved. Next stage, exhaust pipes.

Warning Tail Lamp!

At time of writing, several queries have just come to hand regarding the advisability of using "Silbralloy" for boiler joints. Querists may be interested to know that the makers of this alloy definitely do NOT recommend its use for any vessel subject to pressure, *unless the joints of same are mechanically strong enough to withstand the pressure unaided.* Therefore, if anybody wants to use "Silbralloy," or any other similar substitute for silver-solder (including the "tectics") for sealing the joints in a boiler, every joint must, in the interests of safety, be flanged and riveted in the same manner as would be used for soft-solder caulking.

In addition, an oxy-acetylene blowpipe should under no circumstances be used, because the intense concentrated heat, volatilises some of the constituents of the alloy, and leaves a brittle and spongy residue. I made a test joint, and broke it with my fingers; 'nuff sed!

READERS' LETTERS

Letters of general interest on all subjects relating to model engineering [redacted] welcomed. [redacted] nom-de-plume may be used if desired, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

ELECTRIC HEATING APPLIANCES

DEAR SIR,—May I reply to the two criticisms of my immersion heater in the January 15th issue?

Dealing firstly with Mr. Ackery's remarks, I would say at the outset that I heartily endorse his obvious concern for the safety of your readers, but I feel that his perusal of my article must have been more general than detailed, and the points which he raises are far from being incontestable.

Mr. Ackery mentions that the only provision made for earthing is to connect one lug of the enclosing tube by means of heavy copper wire to the rising water main. True, this was done in my case, but my text reads: "one lug of the tube was connected by heavy copper wire to the nearest earth point, *in this case the rising water main.*"

It is outside the scope of the article to define an earth point, but reference to appropriate works on electrical installations would clear up this point. In my case, the rising water main was quite suitable and was duly tested to ensure that it would clear an earth fault.

I trust that the "lamps" of MODEL ENGINEER readers do not burn so dim that they would earth their electrical apparatus to non-metallic water mains!

On the subject of connection to the mains via the socket outlet mounted on the end of the heater, my text reads: ". . . socket outlet was bolted on to the end of the tube, and used *as a junction box* for the purpose of connecting the element leads to the mains, via a suitable switch."

Mr. Ackery presumes that the socket outlet would be used as a means of connecting to the mains via a live two-pin plug! Whilst I agree that this method would be rank bad practice and dangerous to boot, the above remarks about reader's "lamps" apply again.

Collars moulded on the ends of the element from plastic fire clay, whatever they may be in your correspondent's theory, are quite sound in practice. This material might show a tendency to crack and crumble when used in a thin layer in [redacted] firegrate, where it is subject to white heat and frequent severe attacks from the poker, but in the situation described, where it is subjected to a comparatively low temperature and to no mechanical stress of any consequence it is quite satisfactory.

I agree that it is necessary to maintain adequate electrical clearance, but this is a point of workmanship, not of design, and it is by no means difficult to ensure adequate clearance when burying a short 8-B.A. nut and bolt in ½ in. thickness of fireclay.

Should the element wire break, it might tend to unwind and touch the copper tube, in which case—according to which broken end touched the tube—an earth fault would occur and the fuse protecting the final sub-circuit in which the heater is connected would rupture, clearing the fault. This is the purpose of the fuse.

It is suggested that the use of a single strand of nichrome wire may give rise to conditions resulting in a bad contact, and it is practically certain that the temperature will be too high for many of the plastic socket outlets that are available.

To the first point I would reply that if this is so, then every electrical accessory which uses nichrome wire is unsound in design. To the second point I would say that I chose [redacted] socket outlet with a porcelain interior, but that in fact this component remains quite cool in operation, the only heat it acquires appearing to come from the hot tank adjacent, when the water has been heated.

Turning to the efficiency of the device, Mr. Ackery says no mention is made of insulating the hot water tank. If he will read my article again, he will note that the tank is stated to be lagged with felt and newspaper.

Assuming a supply feed temperature of 40 deg. F. and a final temperature of 190 deg. F. after three hours, the efficiency works out at about 75 per cent. If the lagging were any more efficient than this, there would be complaints from the distaff side, as the cupboard over the tank is used for airing clothes!

I quite agree with the remarks about leaving chippings in the tank, and with reference to the cost of the scheme, I was, I believe, about 7s. 6d. out of pocket—having some 5 amp cable by me.

One further point, in reply to Mr. Barker. The temperature attained by the wire is not governed solely by the amount of current passing through it, but to a major extent by the rate at which heat produced therein can be dissipated, and if the element wire itself were passed down the centre of the tube it would be nearly impossible to dissipate any heat from it, [redacted] it would be surrounded by a very hot tube. It would overheat and fail—I know, I tried it! Hence the admittedly unfortunate necessity for the nut and bolt, which, by the way, is firmly held by the fireclay, is not freely accessible to the air, and does not actually run at a very high temperature—judged by the visible end of the element tube, which barely runs red.

Thanks to both your correspondents for their criticism. I trust that the foregoing will dispel any fears that were felt.

Yours faithfully,

Manchester. D. MAY.

INFORMATION WANTED

DEAR SIR,—I have followed the "Readers' Letters," on the subject of traction engines with great interest.

I wonder if any reader could give me information of the whereabouts, type, and present owners (if it is still in existence) of a traction engine, which in 1949 could be seen on the right-hand side of the Congresbury-Weston-super-Mare road near the humpback bridge, where the railway runs parallel with the road? I only saw this engine from passing trains and 'buses, but it appeared to be a road locomotive of approx. [redacted] n.h.p. A three-quarter length canopy was fitted.

The hind wheels were of larger diameter than usual and straked, no tyres being fitted. From the mud and straw on the wheels, it would appear that at this time, the engine was engaged in agricultural pursuits.

The last time I saw this engine was September, 1949.

Yours faithfully,

Malmesbury. HERBERT J. VIZOR.

TESTING MODEL LOCOMOTIVES

DEAR SIR,—I [redacted] very interested in the article in the January 15th issue of THE MODEL ENGINEER by Mr. Wilkinson on drawbar pull indicators, as I have for some time past been experimenting with a dynamometer truck for testing small locomotives. My present truck has now been in regular use for some months, and comprises [redacted] speedometer reading by ¼-mile steps to 15 m.p.h., an indicator giving the number of feet travelled, and a gauge showing the drawbar pull up to 50 lb.

At first I tried [redacted] piston and cylinder arrangement similar to that described in the article, and that mentioned by Mr. K. N. Harris some time ago. The disadvantages of this type are the accuracy required to ensure oil-tightness, and the fact that curious people would turn the truck over to examine the works, thus spilling the oil from the reservoir. I therefore decided to use an entirely enclosed system, embodying a bellows as the method of compressing the oil. I built up my first model with bellows constructed from tinplate, which proved quite satisfactory on the whole, but, later, having been given a copper bellows from some surplus Air Ministry apparatus, this was incorporated in the final model.

The maximum pressure in this system does not exceed about 30 p.s.i. in this type, so that no great strain is imposed upon gauge or joints.

During the last summer dozens of locomotives have been tested, and I have used the truck for all my regular driving, and no adjustments or topping-up whatever have been needed.

If a more detailed description of this vehicle, with some drawings and photographs would interest readers, I would endeavour to provide material for an article.

Yours faithfully,

London, N.7. M. EDWIN MOON.

THE MODEL SAVERY LAUNCH ENGINE

DEAR SIR,—I wish to thank Mr. A. W. G. Tucker for his article on the above subject, published in THE MODEL ENGINEER of January 8th and to congratulate him on his excellent model.

As he states, this class of small marine engine has almost ceased to exist—unfortunately.

However, I recently visited the works, where, more years ago than I care to remember, I served my pupilage, and I was pleased to find that, although a considerable part of the works [redacted] engaged on the manufacture of [redacted] special type of pump for oil, petrol, bitumen, etc., the construction of steam marine engines from 500 to 1,000 h.p. was still going strong; a number of orders, some for export, were in hand.

With reference to the "Savery" engine I have never seen a centrifugal circulating pump driven off the main engines.

One disadvantage of this arrangement appears to me that when manoeuvring at slow speed (and certainly when going astern) very little, if any, water would be circulated through the condenser.

With [redacted] reciprocating pump driven off the main engines, of course, the quantity of water pumped diminishes with the decrease in speed, but not to the same extent as with a centrifugal pump, and, of course, going astern does not affect the quantity pumped.

Mr. Tucker states that the connecting-rods have a gap between the abutments of the top and bottom brasses to ensure that the nip is taken direct on the brasses.

This, in my opinion, is bad practice, as the bearing lacks rigidity and the brasses are almost certain to nip the crankpin on the sides, and this almost invariably results in a hot bearing.

In the works previously referred to, it was customary in engines of this type to bed the brasses (both crankpin and main bearing) through an arc of about 150 deg. top and bottom and scrape away the rest of the brass to just clear the pin or shaft: liners were fitted between the two halves so that when the bolts were pulled hard up, the brasses bedded top and bottom, but were free to turn without any slackness. When the bearings wear, the liners are filed down to let the brasses together.

Yours faithfully,

Exmouth. A.D.S.

YOUR OLDEST SUBSCRIBER

DEAR SIR,—I can go one better than Mr. Bertram White of New York. I have been, through [redacted] succession of newsagents scattered around the British Isles, a subscriber to THE MODEL ENGINEER since No. 1 January, 1898, and what is more, I have the whole lot, the first 90 volumes bound with the exception of Vols. 30 and 32 which were lost, but which I have in the loose.

That period has seen me through the latter part of my schooldays, my apprenticeship and my subsequent working life into my retirement. Even during the time I was getting seagoing experience I always kept up my order for THE MODEL ENGINEER, and over that long period must have paid quite [redacted] lot for it, money for which I have received full value and more, and innumerable hours of pleasure. Long may it continue to flourish.

Yours faithfully,

Rustington. K. N. HARRIS.

PARTING TOOLS

DEAR SIR,—During the last year or so there have been some very interesting articles by experienced model engineers expressing their theories on the best way to obtain a good "parting-off" job; but, unfortunately, the articles have not proved anything new either in tool design or position of tool in toolpost.

I have not had the practical experience as some of these writers, and cannot, therefore, understand the difficulties which they say attend the job of "parting-off."

I have [redacted] 4-in. Lorch precision lathe, 18 in. between centres, with an adapted *compound slide-rest* and have, on a number of occasions, "parted-off" 2 in. dia. M.S. with no difficulty, using [redacted] standard "parting-off" tool.

May I suggest that the human element plays an important function in mechanics, and a mechanic should be able to feel the tool as it feeds into the job, and by this function can generally help the tool to do its job; of course, speed, keeping the cut reasonably wide and lubrication all help.

Referring to my lathe, it has a certain inflexibility as Mr. E. G. Rix points out in his article, and my suggestion of the human element may in part answer his objection to flexibility.

I rather fancy all lathes, light or heavy, have [redacted] certain amount of flexibility.

Yours faithfully,

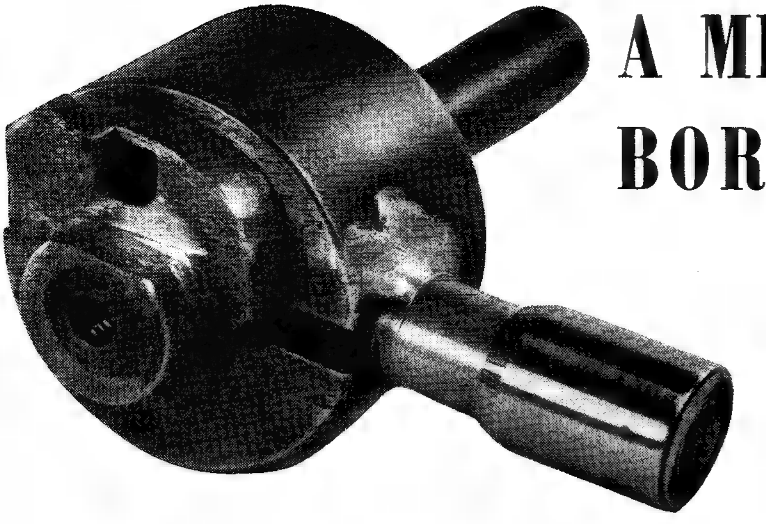
East Barnet. WALTER H. AYRE.

TRACTION DRIVER SHORTAGE

DEAR SIR,—I have read with relish the various readers' letters dealing with road locomotives. In the issue of January 8th Mr. R. C. Stebbing thinks there is a shortage of drivers; this opinion has been expressed before. Well, I have never seen an advertisement yet for them, but, being a steamfitter and turner by trade, with good diesel experience, would consider such [redacted] position if it was offered. After all, no matter how [redacted] person has his heart in [redacted] job, he must live, even [redacted] traction-engine driver.

Yours faithfully,

Hull "KING COAL."



A MICROMETER BORING HEAD

By D. M. Hughes

THIS equipment was inspired by seeing a jig borer in operation, and the necessity for boring out the cylinders of a small locomotive which could not be reamed in the lathe (a Super-Adept). The intention was to make a head that could be fitted in the drilling machine, so that drilling and boring could be carried out at one setting Whilst the attachment was designed for use in a "Union" hand bench drill, it can be readily used in a power drill, or in the lathe, in which case, the shank must be made to suit.

The body of the device is a piece of mild-steel 1$\frac{3}{4}$ in. diameter and 1 in. long. Set up in the lathe, face both sides, centre and drill, and tap $\frac{1}{2}$ in. B.S.F. for a depth of $\frac{3}{8}$ in.

Now obtain a 2$\frac{1}{2}$ in. length of $\frac{1}{2}$-in. silver-steel or B.M.S. and thread it to match the hole in the body. Set up in the lathe by the shank, and skim the face of the body. Whilst still set up, scribe a line around the body at $\frac{5}{16}$ in. from the face. Also, scribe a line across the face of the body at the centre, and continue up the side to meet the line around the body. Centre pop where they meet.

Remove from the lathe and drill a $\frac{3}{8}$-in. hole right through the body. Open out one end to $\frac{7}{16}$ in. for a depth of $\frac{1}{4}$ in. and tap $\frac{1}{2}$ in. B.S.F.

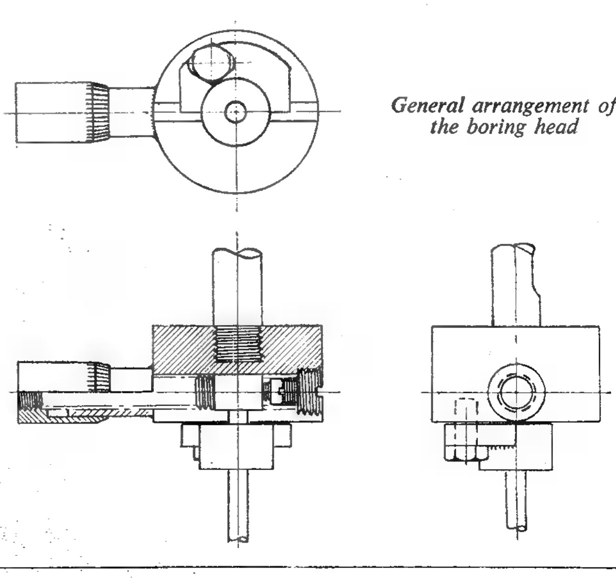
Using the centre-line across the face, mark off and cut, and file a slot $\frac{3}{16}$ in. wide to meet the $\frac{3}{8}$-in. hole. This gives the effect of a "T" slot across the body with $\frac{1}{8}$-in. shank and $\frac{3}{8}$-in. arm. If access to a milling machine is available, the job is simplified.

Now take a piece of $\frac{1}{2}$-in. B.M.S. $\frac{7}{8}$ in. long, face, drill and tap $\frac{3}{8}$-in. B.S.F. File one end so that it fits snugly on to the side of the body. Turn a piece of $\frac{3}{8}$-in. B.M.S. to $\frac{5}{16}$ in. for a length of $\frac{7}{8}$ in. Push this into the body from the larger end of the slot, and place the screwed bush on the $\frac{5}{16}$ in. end. Braze the bush into position on the side of the body. This ensures that the bush and $\frac{3}{8}$-in. hole in the body are in line.

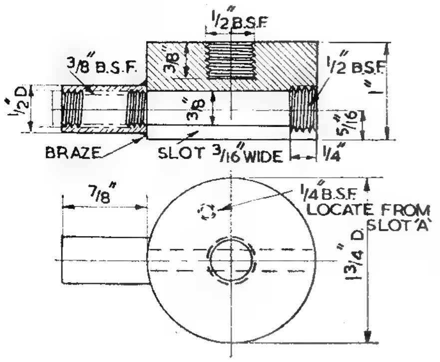
The micrometer thimble is made from a piece of $\frac{5}{8}$-in. B.M.S., $\frac{15}{16}$ in. long. This is bored out to a snug fit on the bush or barrel for a depth of $\frac{5}{8}$ in. The remaining thickness is drilled and tapped $\frac{3}{8}$-in. B.S.F. The forward end of the thimble is chamfered as suitable. Screw in a 2 in. length of $\frac{3}{8}$-in. B.S.F. threaded rod and braze in position.

The next item is the holder for the boring bar. Take a piece of $\frac{3}{8}$-in. B.M.S., $\frac{1}{2}$ in. long, drill and tap it across the diameter $\frac{3}{16}$-in. B.S.W. centrally. Drill and tap $\frac{3}{16}$-in. B.S.W. along the length of the piece for a set-screw. Now take a piece of $\frac{3}{4}$-in. B.M.S., 1 in. long, and turn it to $\frac{3}{16}$ in. diameter for a distance of $\frac{1}{2}$ in. Thread $\frac{3}{16}$-in. B.S.W. for a distance of $\frac{3}{8}$ in. Insert the $\frac{3}{8}$ in. diameter piece in the body, and screw, the adapter into it through the slot in the body, adjusting the thread length until the adapter slides freely across the face of the body without any shake or binding. Tighten the set-screw.

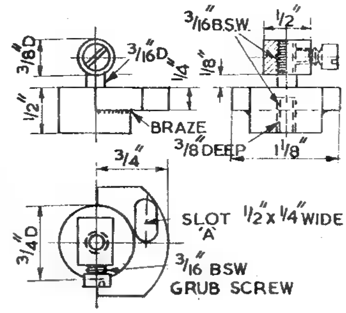
Drill out a piece of 2 in. × 1 in. × $\frac{1}{4}$-in. mild-steel $\frac{3}{8}$ in. diameter to fit the adapter. Slip it on to the adapter, whilst the latter is still



General arrangement of the boring head

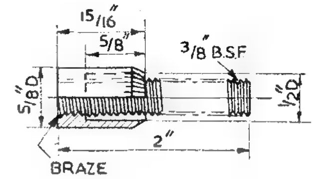


Details of the body



Left—Details of the adapter

Below—The thimble and screw



assembled to the body and braze. Drill a $\frac{1}{4}$-in. B.S.F. tapping hole through this piece and into the body whilst the adapter is set centrally on the body. Remove the adapter, and open out the hole to $\frac{1}{4}$ in. clearing and elongate to $\frac{1}{2}$ in., parallel with the slot in the body. Tap the hole in the body $\frac{1}{4}$ in. B.S.F. and insert a suitable hexagon-headed screw. This is to ensure that there is no shake in the boring bar and adapter in use.

Disassemble the complete adapter, set up by the $\frac{3}{16}$-in. Whit. thread and drill and tap $\frac{3}{16}$-in. Whit. for a depth of $\frac{3}{8}$ in. Drill and tap into this hole from the outside of the adapter for a suitable set-screw. This $\frac{3}{16}$-in. hole is to receive the boring bar itself. The boring bars are of the usual pattern, threaded $\frac{3}{16}$-in. B.S.W. at one end to screw into the attachment.

The micrometer thimble is now divided by using an improvised dividing attachment, consisting essentially of a 50-tooth wheel from an old timeswitch, together with a suitable detent or indicator. To start, scribe a line along the barrel in a suitable position. Insert a boring bar in the adapter, and set as centrally as possible, then giving the screw a $\frac{1}{4}$ turn to offset the bar. Mark the thimble opposite to the scribed line on the barrel. Remove the thimble and set up in the lathe by the screw. Where marked, scribe a line across the chamfer and for $\frac{1}{8}$ in. along the thimble. Carry on round the chamfer, making each tenth line a little longer than the rest. Stamp the thimble, remembering that readings increase as the thimble is screwed in.

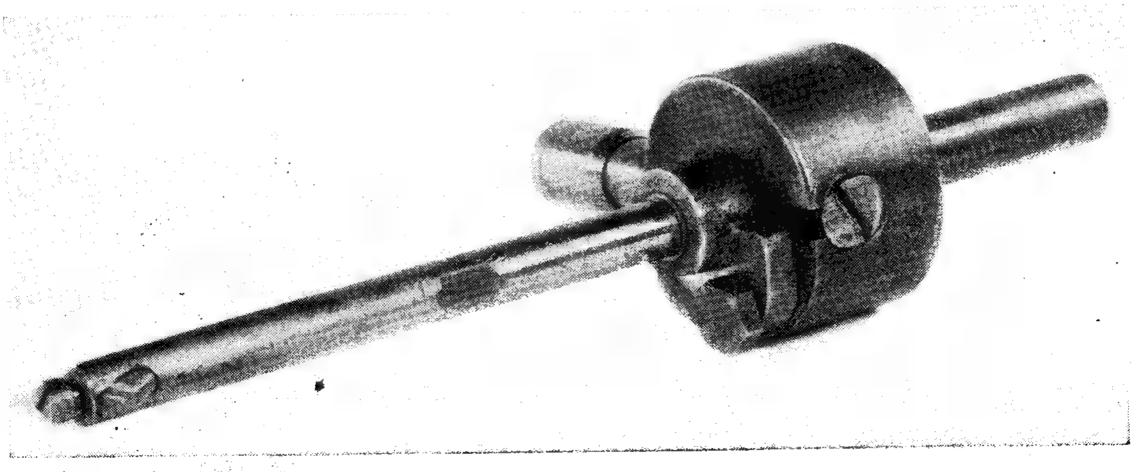
To mark the barrel, first drill the thimble with a 1/32-in. hole as near the edge as possible, on the zero line. Using a piece of $\frac{1}{16}$-in. silver-steel, grind a point that will just protrude through the 1/32-in. hole. Screw the thimble on the barrel, and set to zero. Insert the scriber, turn the thimble and withdraw the scriber. Carry on in this way, making every other line $\frac{1}{8}$ in. long, and the others $\frac{1}{16}$ in. long. Remove the thimble and face back the edge to the centre of the 1/32-in. hole. Stamp the barrel and lightly emery to remove burrs.

Assemble the whole head as follows. Insert the micrometer thimble, fit the adapter and set-screw. Now place a piece of suitable compression spring behind the adapter in the $\frac{3}{8}$-in. hole in the body, and plug with a $\frac{1}{4}$ in. length of $\frac{1}{2}$-in. B.S.F. screw. Screw in a boring bar and set to run true. File off the $\frac{3}{8}$-in. B.S.F. micrometer screw until the micrometer reads zero. This operation could be done in the drilling machine, using a dial indicator.

When in use, the adapter set-screw is tightened down when cutting and slackened off when adjusting.

This boring head has proved to be very useful and accurate, and can, because of its robust construction, take fairly substantial cuts.

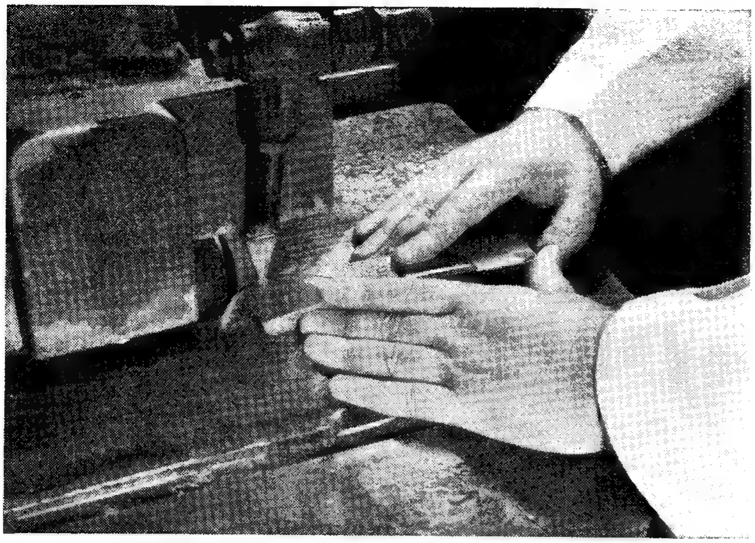
The photographs are by J. Howlett.



Showing the boring bar in position

SHARPENIN

By "Scoti



The tungsten carbide-tipped tool being ground on the top face. Third grade (*semi-rough*) stone

THERE must be few of us indeed who have not heard of the Stone of Destiny, but has it ever occurred to anyone that the performance or life of a tool, indeed, one might even say the destiny of it, is shaped at the grinding stone ?

How often have we seen the result of inexperience, when we have viewed, not without chagrin, the many-faceted tool which is common at a first attempt. I know—I have done it myself !

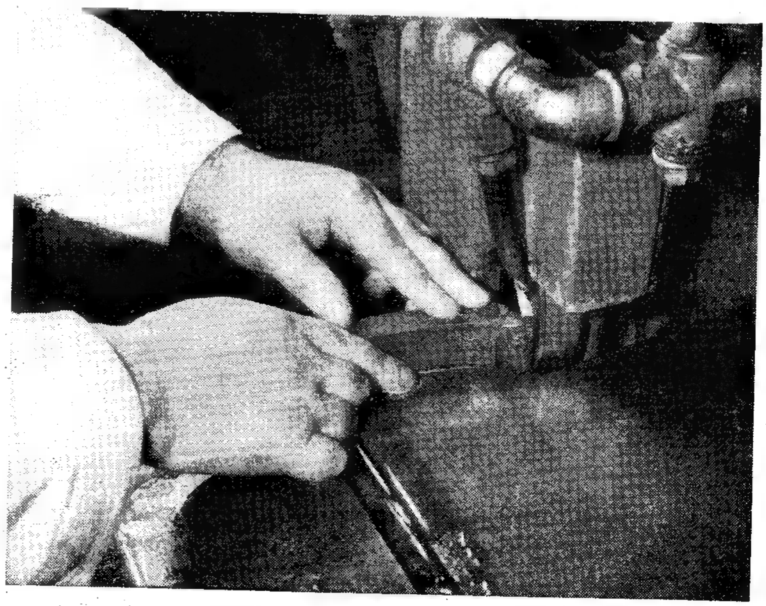
I believe the newcomer is best advised to begin by sharpening, or perhaps I should say grinding tools which are already correct, as to rake, etc., the only requirement being a keen edge. Although it is generally recognised that a grinding rest is a necessary fitment to the grind-stone, unless the latter is of an adjustable type, capable of being set to any angle required, it is of little use to the worker in his efforts to grind a tool, the main requirement of which is an ability to keep the tool grinding on the same planes as the original.

Assuming that the grinding rest is of the fixed type, about 90 deg. to the wheel, the worker must realise that in order to obtain necessary angular grinding, he cannot avail himself of the full use of the latter, and, therefore, the question of personal skill is brought into play. Assuming again that he is right-handed, the tool is held lightly, but firmly in the right hand, resting on the middle finger, supported at the top by the thumb and at the back by the index finger. With the fingers of the left hand giving additional support, and using the rest only as a steady, an approach may be made to the grind-stone with the following aim in view. The flat or face of the tool should be allowed to ride gently on to the side of the stone, when an even contact is made. A little movement over the surface of the stone will instil confidence and impart some idea of what is being done.

An indication that the worker may be departing to some extent from his objective is given by " dragging " occurring in the tool. The main object is to keep the tool grinding on the same plane as the original, and it is surprising how quickly the average worker will learn.

The grinding of tools on the periphery of the stone should only be resorted to when rough-grinding. If a tool is finish-ground on the periphery, a hollow-ground effect is produced and this weakens the cutting edge.

Avoid overheating at all costs, and *never* imagine that the job will be done quicker by pressing with all one's might against the revolving stone. Many " full-size " engineers are guilty of this. Apart from overheating the tool, there is considerable risk of breaking the stone, especially if great pressure is brought to bear on the side of it. Never grind material which is paint-covered—this is fatal to the cutting qualities of the stone, as clogging immediately



Front face of tungsten carbide-tipped tool being ground on a fourth grade (rough) stone

ING TOOLS

' Scotia "

occurs. If paint on metal has to be removed, scrape it off.

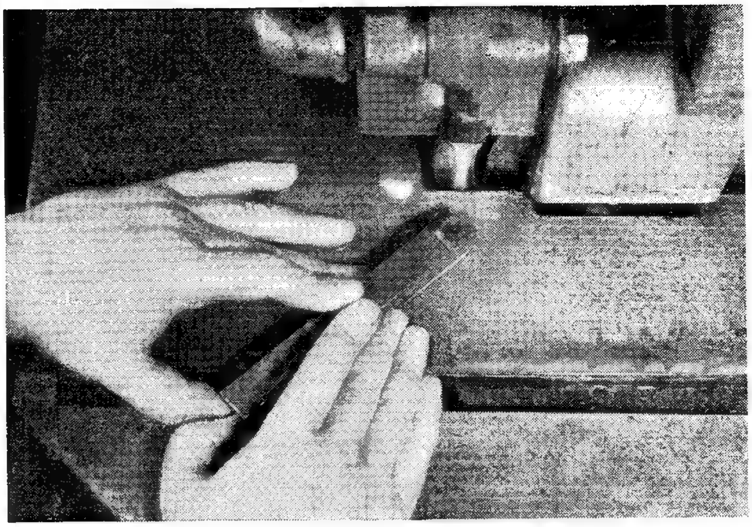
Should it be desired to give a new rake to a tool, proceed as follows : Approach the stone with the tool held firmly in hand. Just short of touching it, decide which angle will suit, and having done so apply the tool firmly to the wheel. A glance will show whether you are on the right track, and if not the angle may be slightly altered. The object is to establish a main facet, and develop it to what is required.

Many industrial plants have angular grinding rests fitted to their grind-stones, especially those dealing with the sharpening and lapping of tungsten carbide tipped tools, and there is no doubt that a properly constructed angular rest fitted to the grind-stone would be of great value to the novice.

The photographs shown appear by kind permission of Messrs. A. & C. Wickman Ltd., the well-known makers of "Wimet" tools, and show some examples of off-hand grinding done in the orthodox manner on tipped tools ; and, although of an industrial character, are excellent examples of the fundamental principles of tool-grinding !

It will be observed that full use of the angular grinding rest is made, as the tool lies flat on it.

Indeed, coincident with the grinding of the various faces, pressure is applied with the fingers in a downward and forward direction—in order to maintain evenly ground surfaces.

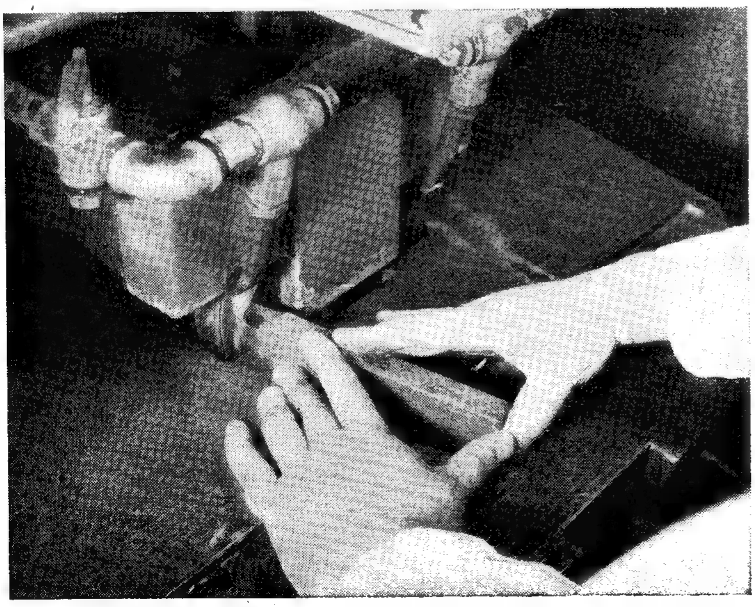


High finish is obtained on the finishing stone. Known as a diamond lap, this consists of a thin circular strip adhering to the side of a metal wheel, and is comprised of diamond dust

A common fault, of which many are guilty, is that excessive grinding is carried out on top of the tool, and while it is recognised that certain types of radius, profile or forming tools can be touched up in no other way, the common turning tool as we know it requires little, if any, grinding on top when sharpening. Provided that correct rake is present, there is little need for grinding down unnecessarily, reducing the life of the tool in general.

Perhaps a few words on the posture one should adopt would not come amiss. A natural position should be taken up which offers every comfort to the worker, and usually consists of the right foot being placed slightly in front of the left one, thus offering the advantage of being able to sway the body slightly to and fro while working, with adequate protection against risk of accident by slipping. If there is a cross-member in the construction of the grindstone, and one is tempted to rest a foot on it while working, there may be a real danger of accident present, as one loses the purchase of having two feet on the floor. However, the latter are minor points, and not likely to arise in the case of the average worker.

If one is able to assume a natural position and acquire confidence in working, there is little need to worry whether it conforms "to the book" or not.



Tool faces being touched up on a semi-finish stone (second grade)

Methods of producing screw threads

By "M.H."

NUTS, bolts, screws and studs are components of nearly every engineering product, whether it be the full-sized job or its model. That, of course, is an obvious fact and nothing has been learnt from it, but it will be interesting to consider types of screw threads for various jobs and materials. The engineering designer has many problems to solve before deciding on the number, diameter, and thread pitch of bolts and screws, etc., that will be necessary to work efficiently. Take, for example, the studding of a cast-iron engine cylinder; generally, a coarse pitch thread relative to the stud diameter will be selected. The reason for this is that a thread form with a large cross sectional area will distribute the stresses over a larger area than would a fine pitch thread. Consequently, when studding cast-iron, aluminium, etc., ■ coarse pitch thread should be selected. A method used by some designers to ensure adequate thread strength in castings is to use a stepped stud. By this means a larger diameter thread can be arranged where it is most needed to give ■ reasonable safety factor in the casting itself. An example of this method is illustrated at Fig. 1. Some people frown on this system as being uneconomical due to the fact that stepped studs are required, but which would cause the least trouble, ■ stripped thread in the casting or ■ stripped thread in ■ nut?

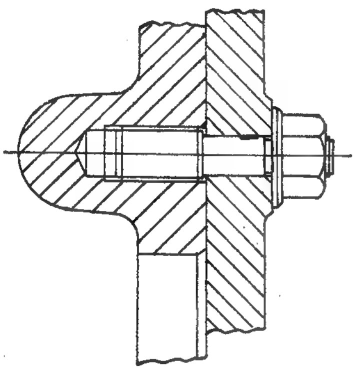


Fig. 1. Showing stepped stud in casting

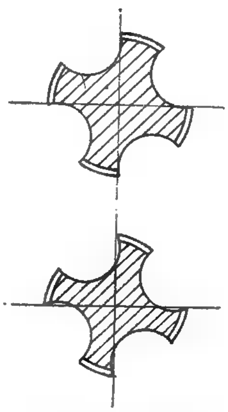


Fig. 2. Cut thread tap (top) and form relieved tap (below)

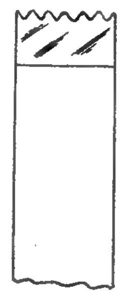


Fig. 3. Showing a typical outside hand chaser

Thread systems such as British Standard Fine are suitable for steels, especially for some types of mild-steels which have to be tapped. I have known mild-steel to defy the removal of a cut thread tap due to the steel's "stickiness" and the binding of the thread lands of the tap. The answer to the sticking trouble lies in the use of a form-relieved ground-thread tap, or as ■ temporary alternative, a cut-thread tap with ample chip clearance and short lands.

For external screw threads, the primary method of manufacture is by hand chasing in the lathe. This method is best learnt by practice, as machinists develop their own technique as they go along. Some people cut with the trailing edge of the chaser, and some use the leading edge, and there are, of course, variations between the two methods. For sizing the thread and still maintaining firm pressure on the chaser, a variation in depth of cut can be achieved by very slightly raising the cutting edge of the chaser above centre-line.

The most usual method of screw-cutting is, by the use of ■ single-point tool. Many words have been written on this subject already, so I will leave the explanation of one or two methods to the sketches in Fig. 4. After cutting a thread with a single-point tool there is a further small operation to complete the thread—that of cutting the radius at the crest of the thread. The three commonly used methods are by the use of (a), the die nut or circular die; (b), the fine file; (c), the hand chaser. It is as well to remember that in normal cases, the crest and root of a thread are clearance, and no binding must take place here.

When cutting threads in quantity on the lathe with the ordinary circular die, the problem is to prevent the die cutting a longer thread than is required. A self opening die head would solve the problem, but, generally speaking, these will not be found in the small workshop. A good second choice would be the self releasing tap and die holder. Although these attachments are simple in principle, their price today would be prohibitive to many people, so the next best thing is to make one, and if kept clean in the right places, it will give many years of good service. The sketch, Fig. 5, shows the general principles and proportions. It will be necessary to fit the lathe tailstock with a lever feed attachment and some sort of stop arrangement (Fig. 6), so that in use, the die is fed up to the work,

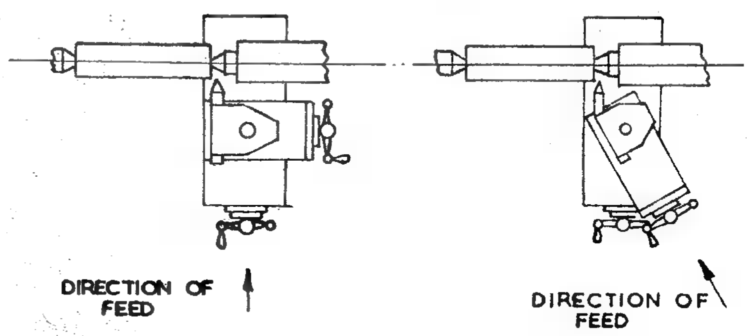


Fig. 4. Methods of screwcutting by single-point tool

which is, of course, revolving; gentle pressure is kept behind the die with the lever until the pre-set stop is reached. The die will continue to cut for a further small distance, when the head of the attachment will be released from the driving pins and begin to revolve with the work. To withdraw the die, the lathe spindle is reversed and gentle back pressure applied at the lever will cause the die to run off the work, the head now being held by the engagement of the back driving peg. Tapping can, of course, be performed by a similar method.

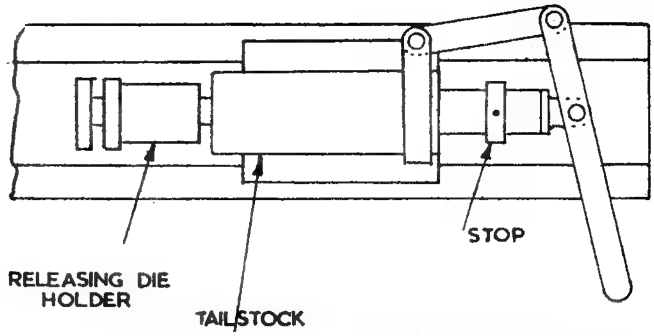


Fig. 6. Lever feed and stop arrangement for lathe tailstock

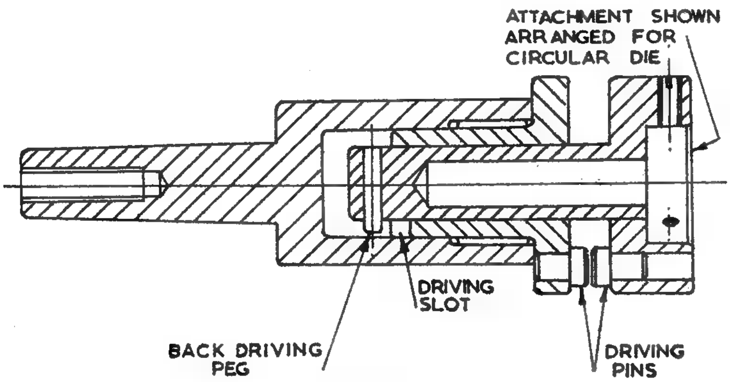


Fig. 5. General arrangement of releasing tap and die holder

For quickly cutting accurate internal and external threads with the minimum of trouble, the circular chaser can be used. These chasers can be readily purchased, and have a ground and lapped thread form, but here again the cost would probably appear excessive for the average model engineer or amateur machinist. It is possible, however, to make one's own circular chasers with reasonable results by the following method. Assuming that we require a circular chaser to cut external right-hand threads, the blank *A*, Fig. 7, is turned up from a suitable tool steel, and the thread form is screwed left-hand, using a right-hand tap as a screwcutting tool. The pitch which we require on the job is, of course, the same as the tap pitch. The cutaway is next made to form a cutting edge, and the chaser is hardened and tempered. After sharpening with an oil stone and attaching to a suitable shank, we are all set to go. The helix angle of the thread has been taken care of by cutting a left-hand thread on the chaser. If we wish to make left-handed threads on our work, then the chaser is screw cut with a left-handed tap. Internal circular chasers are made as shown in the sketch, Fig. 8, a circular die being used to produce the thread form on the blank. In this case a right-hand die will make a chaser for cutting right-hand threads. If we possess a set of thread form chasers, we will find that accurately-formed threads are cut with ease, and the next step is to provide ourselves with a set of male and female gauges.

The male gauge is quite straightforward to make if we use a circular chaser as a screwcutting tool, the size can be measured with a micrometer as the circular chaser forms a thread which includes the crest radius. If we wish to make an

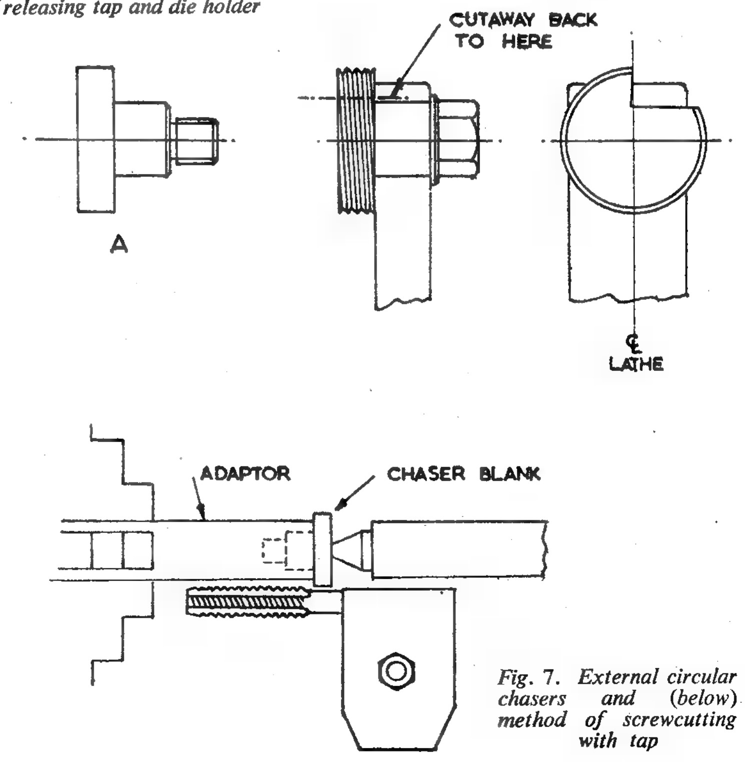


Fig. 7. External circular chasers and (below) method of screwcutting with tap

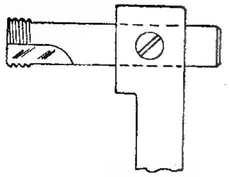


Fig. 8. Internal circular chaser and holder

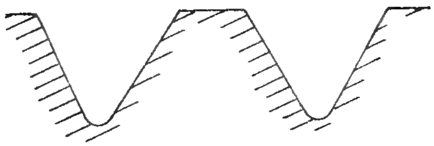


Fig. 9. Showing a truncated thread form

effective diameter gauge, the form is truncated by a third of the thread depth, as shown in Fig. 9.

Ring or female gauges are a little more difficult to make, due to the fact that they are awkward to measure accurately. One method of manufacture which is used in many small toolrooms is to make the bore of the gauge a few thou. below the root diameter to allow for cleaning up by the internal chaser. The gauge is then bored to the "spot-on" size of the outside diameter of the thread for about 1/8 in. deep, and when cutting to size the chaser must only just scrape this diameter. The excess metal on the face of the gauge is, of course, removed and the wafer thin edge of the first thread is carefully filed away.

Such methods as thread rolling and thread milling are normally well out of range for most of us, but perhaps a brief description of the above systems would be of interest.

For thread rolling, the diameter of the work is made undersized by a predetermined amount, and rollers on which a thread is formed are brought to bear on the work and fed in to depth. The work is squeezed to the form of the thread, the undersized bar being made to flow uphill as it were, until it is on size. Another method is to use two dies on which are cut grooves of screw thread form. These two dies are passed across the work in such a way as to squeeze the bar between them, so forming a thread.

Thread milling is performed on a special machine which in many ways resembles a centre lathe. The work is held in a chuck or fixture in the headstock of the machine whilst a milling cutter is arranged to cut the thread. A leadscrew, which is driven by change wheels, guides the cutter in much the same way as in ordinary screwcutting on the lathe.

Thread grinding is almost the same as thread milling, with the exception that a grinding wheel is used instead of a cutter. The grinding wheel has a series of grooves of thread form on its face, and is also traversed by a leadscrew.

FOR THE BOOKSHELF

Railways the World Over, by G. Freeman Allen. (Hampton Court: Ian Allan Ltd.) 128 pages, size 8½ in. by 11 in. Price 12s. 6d.

This is a book that should appeal to intelligent youths whose interest in railways has progressed somewhat from that of the younger schoolboy. It is very fully illustrated by excellent photogravure reproductions and there are several coloured plates.

The text deals, not too profoundly, with most of the aspects of railway operation; at home and overseas. The descriptions of mechanical devices are concise, clear and accurate, and we can cordially recommend the book as an ideal gift for those for whom it is intended.

British Express Locomotive Development, by E. C. Poultney, O.B.E. (London: George Allen & Unwin Ltd.) 175 pages, size 7¼ in. by 9¾ in. Fully illustrated. Price 21s. net.

The contents of this book were originally published during 1947-50 in *Modern Transport*, and are now reprinted in book form in order to make them readily available to a wider public. We feel that this step is certain to prove thoroughly well worth while, for Mr. Poultney has brought a fresh approach to his subject, and treats it in a very personal manner. The fact that he is a locomotive engineer with a very wide and long experience at once gives authority to his treatise; but we notice, with much satisfaction, that he has set down an exhaustive, if concise, factual record that is all the more valuable because of the scrupulous avoidance of the expression of purely personal opinion.

The record begins with some recollections of the year 1896, and thenceforth traces, step by step, the story of the gradual development and improvement of the British main-line express passenger locomotive. There is, of necessity, much technical information included, but the author's treatment of it is always highly interesting and very easily understandable, even by the least-informed reader. The work of the many famous locomotive engineers involved is here set out accurately and logically, and the reader can scarcely fail to realise that, far from the oft-repeated idea that locomotive development has hardly advanced since the time of the *Rocket*, the plain fact is exactly the opposite, though it may have been so gradual as almost to escape notice! Although this book covers only the last 50 years before nationalisation, it shows clearly enough that a great deal of development had taken place before the beginning of that period and steadily continued until the end of it.

The illustrations are excellent, some of the halftones being new to us, and there are some interesting line drawings of certain important features and details; these enhance the value of the book which becomes thereby a useful work of reference. We like especially the method of frequently tabulating important ratios and proportions, which enable comparisons to be made of various classes of locomotives; these tables alone give plenty of evidence of how the ideas of locomotive designers not only differed from each other at different times, but show marked advances during the last 50 years. Realisation of the effects of modifying certain details and proportions has led to a remarkable degree of unification of thought among locomotive engineers, which this book makes abundantly clear.

The book is a valuable addition to the literature of the locomotive, and will, without doubt, hold its place for many years to come. Although it deals almost exclusively with express passenger locomotives, some of the information in it has a wider application.

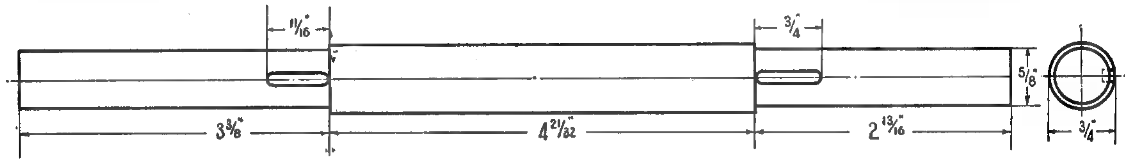
The Allchin "M.E." Traction Engine to 1½ in. Scale

BY W. J. HUGHES

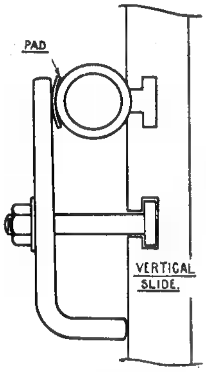
NOW that all the bearings are machined up, the next logical thing to do is to machine the shafts to fit them, which will involve some turning between centres, and some cutting of keyways. Nothing very complicated about them, really; machining the four splines from the solid on the second shaft will be the worst job.

Hind Axle

Mild-steel should be quite suitable for the shafts, which are massive enough to stand all the strain that will be put on them. At the same time, however, anyone who has access to a better grade of steel should not miss the chance of using it. For the hind-axle, for instance, a half-shaft of suitable diameter from the back axle of a scrapped car would be just the thing, and if the scrap-yard dealer is reasonable, might prove cheaper than the mild-steel bar.



Hind axle for the Allchin



Sketch to show method of holding shafts when milling keyways

The finished diameter of the hind axle is $\frac{3}{4}$ in.; if you use a piece of bar which is that diameter to start with, the centres in the ends will need to be *very* accurately marked out and drilled in order that the hind wheel journals will be exactly concentric when turned. Personally, I prefer to use stock a little oversize for a start—say, $\frac{7}{8}$ in. diameter—and to run it down to correct size after centring the ends. This does at least make sure that everything is right.

The finished length of the axle is 10 27/32 in., so take a piece a little longer, and face and centre one end. Since, obviously, the bar will project too far from the chuck to do this in the ordinary way, the outer end of the bar must be supported in the fixed steady. Set it to run true, face the end with a knife tool, and centre it with a centre-drill held in the tailstock chuck.

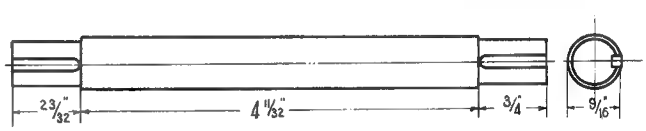
Reverse the bar in the lathe, and face the other end to length: then centre this end. Remove the steady, plug the centres in to the sockets of mandrel and tailstock, and rough-turn the axle between centres, leaving it a few thou. oversize on all dimensions. Most people have their own preference for a tool for rough-turning: mine is for a round-nosed one, with the " point " about $\frac{1}{16}$-in. radius.

For the finishing cut I like to use a stiff knife-tool, newly-ground, and honed with an oil-slip, with which the front corner of the tool has been rounded to a very small radius. The first cut may be taken over the $\frac{3}{4}$ in. dia. part of the axle, which is to run in the bearing brackets, of course, and which should, therefore, be turned to the same diameter as the plug-gauge we used when boring these.

Then turn the shorter of the journals to diameter—$\frac{5}{8}$ in.—at the same time finishing the shoulder at $2\frac{13}{16}$ in. from the end. Remove the carrier from the other end, grip the one just finished (with a small pad of copper or brass sheet under the screw to protect the surface), and finish the other journal to $\frac{5}{8}$ in. dia. and a length of $3\frac{3}{8}$ in., which *should* leave the central part 4 21/32 in. between the shoulders. *Note*: this last is the really important dimension, and although the other two should be correct, for your own satisfaction, either or both could be up to 1/32 in. short without detriment to the finished traction-engine.

Third Shaft

The third shaft is turned in the same way as the hind-axle, of course, the only differences being in the dimensions. Diameters are $\frac{9}{16}$ in. for the shaft, with a length of 4 11/32 in., and $\frac{1}{2}$ in. for the spigots, with lengths of 23/32 in. and $\frac{3}{4}$ in. respectively.

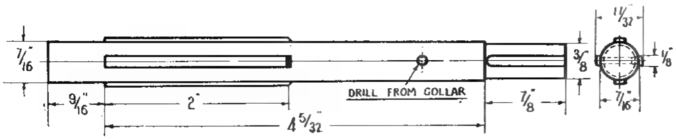


Third shaft

Second Shaft

On the second shaft, four splines have to be machined, on which the change-speed spur-wheels slide to and fro. In turning the shaft, therefore, this part will have to be left to the diameter of 17/32 in. for a length of 2 in., the rest of the shaft being $\frac{7}{16}$ in. dia., with a spigot at the right-hand end $\frac{3}{8}$ in. dia. for the second motion pinion. Note, by the way, that the right-hand ends of the splines are not vertical, so that this shoulder should be

Continued from page 100, January 22, 1953.



Second shaft, with four splines machined from the solid

finished with a round-nosed tool, and not the knife tool.

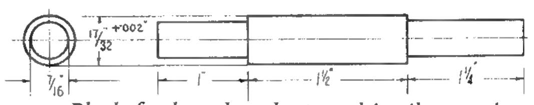
The method of machining the splines will be described in the next instalment, all being well, but it will have to be duplicated in making a broaching tool with which to finish the mating keyways in the boss or centre of the change-speed spur wheels. So while we are turning between centres, and before we start milling the keyways in the three shafts, we may as well turn the blank for the broach.

This is as given in the sketch, and is turned from $\frac{9}{16}$ in. dia. *silver*-steel. Exact lengths are not vital, but the diameters given should be adhered to very strictly, since they will affect the sliding fit of one component on the other.

Machining the Keyways

There are various methods of machining the keyways, of course, but I think the best method for our purpose is to end-mill them. So let us take the hind axle first.

When operating on a shaft mounted on the vertical slide, it is common practice to mount it in vee-blocks. However, it is less complicated, and usually just as efficacious, to clip it in position resting in one of the tee-slots of the slide, as in the sketch. Since the edges of the slots are slightly chamfered, there are no sharp corners to " dig in " to the finished surface, and since there is no great stress in this operation, a single clip will suffice to hold the work : though it might be as well to put a scrap of copper or brass sheet between the clip and the shaft.



Blank for broach to be turned in silver-steel

The Tool for the Job

The end-mill may be made in the usual way ; this has been often described in these pages, so need not be gone into again. In this case, however, where it is proposed to use silver-steel of $\frac{1}{8}$ in. and 3/32 in. square section respectively for the keys, which should be a tight fit in the shaft keyways, of course, the cutters may well be a few thou. smaller in width than the keys. Then, if the key will not fit into its seat, a light scraping cut can be taken off each side of the latter with the slide moved slightly up and down respectively, until the key *will* fit.

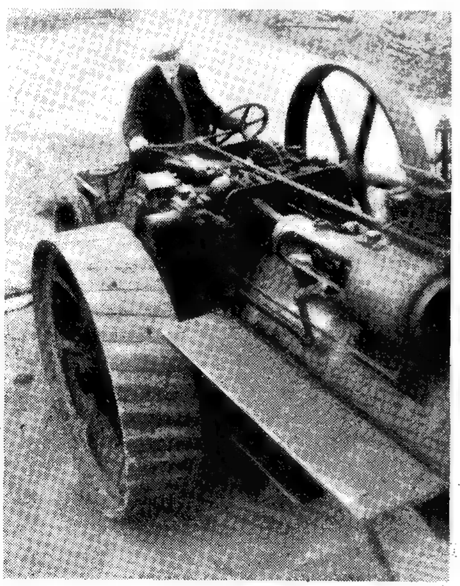
Incidentally, the stock from which these small end-mills are made should not be less than $\frac{1}{4}$ in. diameter, and the business end should be short and stubby, not long and slender. When the work is set up on the slide, it must be checked carefully at each end, with the surface gauge on the lathe bed, to see that it is exactly horizontal.

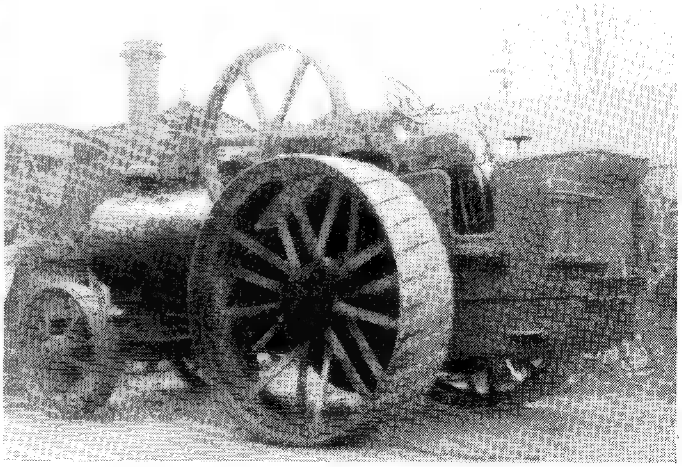
Then with the faceplate mounted on the mandrel nose, check the distance between it and each end of the shaft, to see that the latter is exactly parallel with the plate, and so square with the lathe axis. Inside calipers are best for this job; measuring each end with a rule is not good enough.

Finally, it is essential that the centre-line of the shaft is exactly at the centre height of the lathe ; this may also be checked with the surface gauge.

The end-mill should run true, of course, and if your three-jaw chuck doesn't, the offending jaw may be packed as necessary. Alternatively, the cutter may be used in the four-jaw, or, best of all, in a collet chuck.

Revolve the cutter at the top speed





Photograph No. 24. Three-quarter rear view of " Royal Chester " at her present home

Left—Photograph No. 23. Mr. H. W. Matthews, former test driver of Allchin's, at the controls of " our " engine during a visit to Kent

of the lathe—even then it won't be travelling as fast as it should, unless you have a new " Super Seven " !—and be content not to dig too deeply at each cut, nor to traverse the work too fast. Even with a short, stubby cutter, accidents *will* happen if one tries to be too forceful !

When the seats or keyways have been cut in the hind axle, those in the second shaft may be machined, using the same cutter.

With the second shaft, this had better be mounted on a couple of vee-blocks ; otherwise the double diameters will make it awkward to hold. As it is, one block will fit under one $\frac{7}{16}$-in. dia. journal, and the other under the other, leaving the part to be machined projecting. This keyway, remember, is 3/32 in. wide, and not $\frac{1}{8}$ in., like the others.

Personal Note

One or two readers have written in—nicely, I admit—hinting that it would be nice to have another sheet or two of drawings to go at, so perhaps a word on this subject may not come amiss.

First, I have a whole pile of drawings, from rough sketches to the finished article, all dealing with our Allchin. Some of these contain ideas—the boiler, for instance—which need testing before publication, but others, notably of the front wheels, axle and associated fittings, are almost ready for tracing and will be done as soon as possible.

Secondly, I have a full-time job which earns the family bread-and-butter, and which cannot, therefore, be neglected, even if one were so minded. Added to this are domestic and social responsibilities, a heavy postbag, and meetings of various kinds. To top all this, in the past few months my lot has included a certain amount of illness, which has meant that the workshop has been taboo for weeks on end. So that, all in all, my time is pretty fully occupied !

However, I *can* assure readers that I am just as anxious to see my *Royal Chester* under steam as they are theirs, and that no effort will be spared to achieve that end. As it is, I hope to have the next sheet of drawings—front wheels, etc.—ready very shortly, and will make an announcement to that effect as soon as it is.

Photographs

Photograph No. 23 shows Mr. H. W. Matthews at the controls of *Royal Chester* at her present home in Kent. As readers of my book will be aware, Mr. Matthews used to be test-driver to the Allchin firm, and as this was their last engine, he has a strong affection for the old girl. I am indebted to him for sending the photograph, which will be of value to builders of the model, as will photograph No. 24, which was taken at the same time. Both are by Mr. Matthews' son.

(*To be continued*)

FLEX SUPPORT FOR AN ELECTRIC IRON

THE article described here will be found to be equally as effective as, and very much cheaper than the commercial models now on the market. It is of great assistance when ironing, and the construction is well within the capabilities of any average handyman or woman, needing no special tools, and utilising materials which if not already to hand are very easily obtainable.

A piece of $\frac{3}{4}$ in. square wood, 3 in. long, is drilled at one end with a $\frac{3}{8}$ in. diameter hole, 1 in. in depth, into which is glued a length of 15 in. of $\frac{3}{8}$ in. diameter dowel-rod.

At a point 1 in. from the opposite end of the square piece of wood, a $\frac{1}{4}$ in. diameter hole is bored right through.

In assembling this device to the ironing board, as shown in the diagram, a $2\frac{1}{2}$ in. long No. 8 woodscrew is passed through the hole in the square piece of wood and screwed into the side edge of the ironing board just in front of the iron rest, a small coil spring being inserted between the head of the screw and the support.

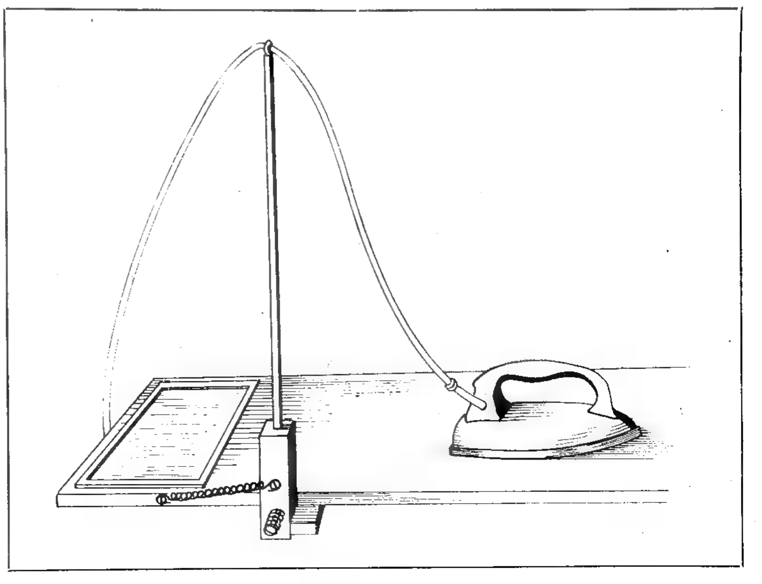
Insertion of the coil spring, and the fact that the hole is larger than the woodscrew, allows the support to " spring " in a direction across the ironing board, as well as swinging backwards and forwards.

The support now needs only the addition of a spring, which consists of a short length of spring curtain wire, and a backstop, which is a small piece of wood screwed to the underside of the ironing board, as shown, to prevent the support falling over backwards.

A round-headed woodscrew is screwed into the top of the dowel-rod and the electric iron flex is attached to this by means of a short, thick elastic band.

In use, the iron flex should be attached to the top of the support at such a distance from the iron that the iron will just reach the pointed end of the ironing board when the support is well tilted over.

When the ironing board is not in use the flex may be unhooked from the support, and the support itself, after unhooking the spring, will turn down and lie flat alongside the board out of harm's way.—D. MAY.



Faceplate clamps and dogs

By "Duplex"

CLAMPS are largely used for holding work of various shapes on the lathe faceplate, and with these fittings there is the advantage that the abutment face of the work-piece is held in close contact with the flat, true-running surface of the faceplate.

From this it follows that if the work, after being faced on one surface, is turned over and the opposite side machined, the two machined surfaces will be exactly parallel. Where a 9 in. dia. faceplate is fitted to a $3\frac{1}{2}$ in. lathe, quite large parts can be machined, as long as they will swing in the bed gap.

The four-jaw chuck, on the other hand, may not be large enough for this purpose and, if special care is not taken, irregular work is liable to lift as the chuck jaws are tightened ; this will result in the work surface not being machined parallel with the base of the part.

There are many varieties of faceplate clamps, and the simple, Myford pattern, shown on the left of Fig. 1, has a beak to press against the work and a long slot for the clamping-bolt.

In use, the outer end of the clamp is supported on a packing block, approximately equal in height to the thickness of the work, and the clamping-bolt is inserted with its head outwards and then tightened until the work is securely held. Two or more clamps will be required, and they should be tightened in order, a little at a time, to avoid distorting the work, just as one tightens the cylinder-head nuts of a petrol engine.

In addition, a piece of card or blotting-paper, placed between the part and the faceplate, will allow the work to bed evenly and will give a more secure hold with less clamping pressure.

The more elaborate clamp, shown on the right of Fig. 1, does not need a packing block, for the jack-screw illustrated in Fig. 2 can be set to the height required ; but, where the end of this screw lies over a faceplate slot, a bridge-piece is used to take the pressure. The jack-screw can be reversed, if necessary, to obtain greater height for holding large work.

The method of securing a casting to the faceplate with two of these clamps is shown in Fig. 3, and a side view of the set-up is given in Fig. 4. A convenient way of applying these clamps is to adopt the method used with the ordinary toolmaker's clamp ; that is to say, the central clamp-bolt is first tightened until the clamp lies approximately level, and the jack-screw is then tightened to apply the clamping pressure.

Where the distance between the centres of the jack-screw and the clamp-bolt is made greater than that between the clamp-bolt and the point of contact with the work, additional leverage and increased clamping pressure are obtained. However the clamping pressure is often applied by first setting the clamp level by means of the jack-screw and then tightening the clamp-bolt ; the method usually adopted for securing a lathe tool under the toolpost clamp plate is a familiar example.

The dimensions of the clamp and its bolt will depend on the size of the lathe faceplate and the width of the faceplate slots, but the clamps should always be made fully strong, as the hold will be uncertain if the clamp bends under the bolting strain. The dimensions given in Fig. 2 are suitable for a mild-steel clamp for use on the faceplate of a $3\frac{1}{2}$ in. lathe. Tapering the end of the clamp to form a beak will often help to get better contact when mounting irregularly-shaped work. It is advisable to make a set of four of these clamps, as all may be needed where the clamping surfaces are small and inaccessible, and a secure mounting is necessary for heavy machining. The finished clamps should be numbered,

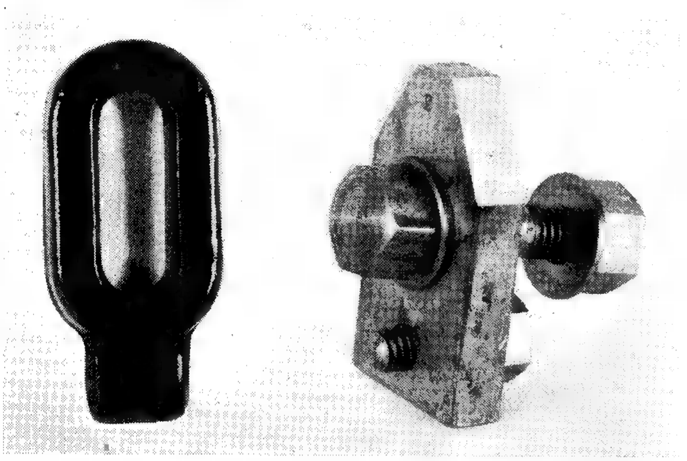


Fig. 1. Left—a plain faceplate clamp. Right—a clamp with clamp-bolt and jack-screw

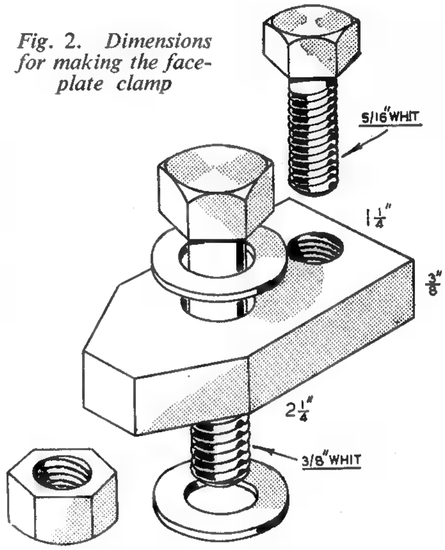
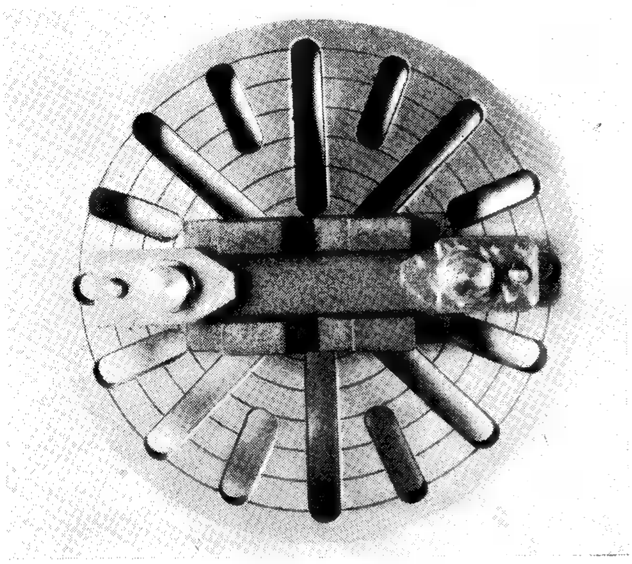


Fig. 2. Dimensions for making the faceplate clamp



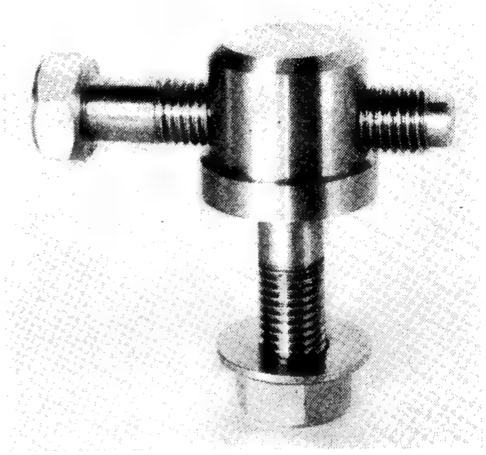


Fig. 5. A small faceplate dog

Left—Fig. 3. A casting secured to the faceplate with a pair of clamps

like the jaws of a four-jaw chuck.

Faceplate Dogs

These fittings, when secured to the lathe faceplate, are used for the light machining of parts that cannot readily be held in the four-jaw chuck or secured with clamps. The holding power of the type of dog illustrated in Fig. 5 is not great, but the grip can be increased if four or more of these fittings are used. These dogs are also useful for positioning work held by faceplate clamps; in this way, a number of parts can be machined uniformly by emoloying the dogs solely as fixed stops to register the work on the faceplate. The dimensions of the dog illustrated in Fig. 5 are given in Fig. 6, and it may be found worth while making up a set of these fittings, for they have the advantage of holding the work by the edge only and leaving the whole surface clear for machining. If preferred, the dogs can be made from square steel bar, but round stock has been specified, as it is usually more easily obtainable and is less trouble to mount in the chuck. The actual machining is straightforward and needs no description. The only difficulty may be in drilling the hole for the clamp-screw truly on the diameter, but if this hole is, at the outset, drilled in the unmachined bar, and a cross-drilling jig is used to guide the drill, there should be no mistake.

Make the threaded shank of the dog fully long, as for holding some work-pieces it may be found advisable to raise the dog on a distance collar in order to give the clamp-screw a better bearing on the work.

Dogs of this kind are sometimes made with a register to fit in the faceplate slots, in order to keep the dog from turning when being bolted in place; but this prevents the dog being set obliquely, as may sometimes be found necessary. To overcome this difficulty, the dog can be held by means of a tommy bar if a hole is drilled on either side of the head.

The more elaborate type of faceplate dog illustrated in Fig. 7 corresponds to the jaw mechanism of a light four-jaw chuck, and the jaw portion can be reversed for inside or outside holding.

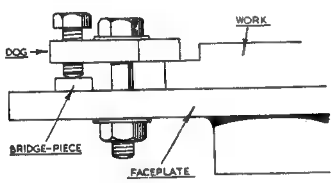


Fig. 4. Applying a faceplate clamp

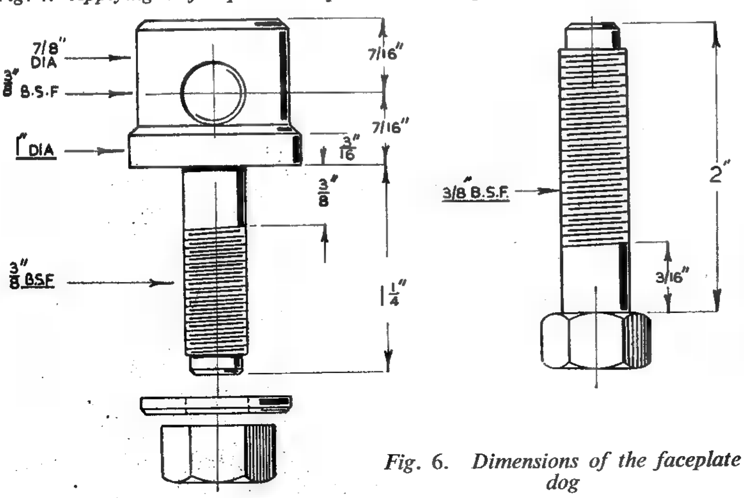


Fig. 6. Dimensions of the faceplate dog

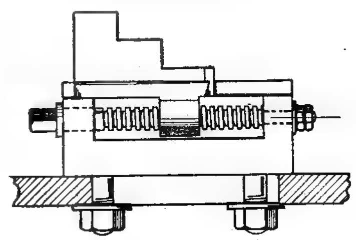


Fig. 7. A faceplate dog with reversible jaws

THE CONSTRUCTION OF MODEL PROPELLERS

By P. W. Thomas

A PROPELLER drives the ship forward by receiving water which flows to it round the stern of the ship, and giving this water increased velocity away behind the ship. In other words, the propeller ejects a column of water behind it, and the reaction or recoil from this water pushes the ship forward.

In order to give this increased speed to the water, the propeller blades are set at an angle, so that as they strike the water continually, it is flung away from the blades, in a column whose diameter is approximately that of the propeller, and in a horizontal direction behind the propeller. If one blade was continued around the whole propeller, it would appear like one thread of a screw; and if it was given one turn in an appropriate nut, it would move forward by a distance equal to the " pitch " of the screw-thread. This distance is called the pitch of the propeller. But since, in water, the propeller actually propels by giving the water a greater velocity, the distance it moves the ship forward in one turn is always less than the pitch. The amount by which it is less is called the " slip." In models it is likely to be about 30 per cent. It is important to realise that if there were no slip, there would be no propulsion.

As the propeller revolves, the tips of the blades are moving around a circular path at a higher speed (since they have farther to go) than the rest of the blade. The roots, or points at which the blades are set into the boss, are the slowest moving parts. If the blades were flat, each part of them would be striking the water at a different speed, and instead of a smoothly flowing column of water, a mass of whirls and eddies would be set up behind the ship. The blades change their angles, therefore, along their whole length, the angle becoming less towards the tips, so that the column of water delivered is as uniform as possible.

Stresses on Propeller

The various parts of a propeller are subjected, when working, to a number of different stresses ; they must be of adequate strength to resist these. The boss, and its attachment to the shaft, are undergoing torsion, or twisting. The blades are subject to centrifugal force, which tends to pull them out of the boss, and to bending stresses, which tend to curl them round the boss, in the opposite direction to that in which the propeller is rotating. The author once ran a flash steam hydroplane on a pond with floating ice, and literally wrapped the propeller blades round the boss.

Materials

The propellers dealt with in this article are built up ; that is, the boss and blades are made separately and fixed together. Excellent propellers may be made from castings in iron or bronze, but it is usually much easier for most amateurs to fabricate propellers from stock round bar and flat sheet.

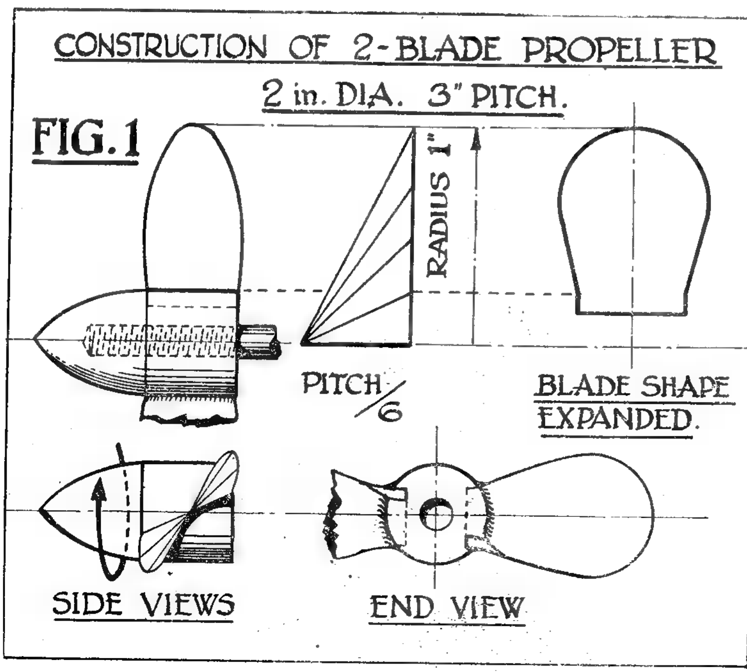
Where a propeller is highly stressed as in the case of a boat built purely for speed, the propeller may be made of steel. For scale models, brass is sufficiently strong; in both cases, the general construction is the same. The sizes of material most likely to be required are round bar, from $\frac{3}{8}$ in. to $\frac{3}{4}$ in. diameter, and flat sheet from $\frac{1}{16}$ in. to $\frac{1}{8}$ in. in thickness.

Pitch and Blade Angle

If the engine revolutions and the speed which is required from the ship are known, a suitable propeller may be set out and made. The speed should be reduced to feet per minute and divided by the number of revolutions per minute; this will give a figure in feet, or decimals of a foot, for the pitch. It should be multiplied by 12 to bring it to inches, and 30 per cent. added for slip.

For example :

Required speed of ship, 6 m.p.h.;
Engine revolutions, 2,000 per min.
6 m.p.h. = 528 ft. per min., so the ship will need to do $\frac{528}{2{,}000}$ ft. per revolution of the propeller. This equals 0.264 ft, or 3.17 in. Adding 30 per cent. we get. nearly $4\frac{1}{4}$ in. which is the pitch we need to give the required speed. The diameter may be made from a half to three-quarters of the pitch; in this case we will try 3 in. diameter to start with, and cut the blades down a little if the engine proves unable to develop its 2,000 r.p.m. with the 3-in. propeller. Even full-size propeller design is to some extent a matter of trying and finding out !



The propeller may now be drawn out. First the blade angles must be set out. A vertical line is drawn, and on it are marked the radius at the boss, and at the tip. A couple of intermediate positions may also be put in. It will be found easier in the case of small propellers to draw them twice full size or even larger. At right-angles to the bottom of the vertical radius line is drawn another line, in length equal to the pitch divided by 2π, which for model work may be taken as 6. Fig. 1 shows these lines drawn for a propeller 2 in. diameter (1 in. radius) $\times$ 3 in. pitch. By joining the end of the pitch line to the radius points, a series of inclined lines is obtained which gives the blade angle at the corresponding radius. If the diagram in Fig. 1 is compared with the side view of the propeller, the way in which these lines give the blade angles will be seen.

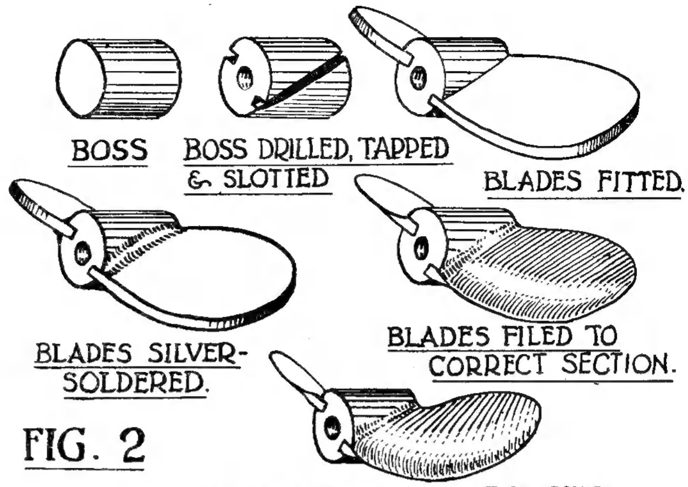


FIG. 2

STAGES IN CONSTRUCTION OF PROPELLER.

Blade Shape

Propeller blades may be symmetrical or "raked" (*see* Fig. 3). A raked blade generally slopes away from the direction of rotation; it may also project aft of the boss. But it is very doubtful whether in model sizes any increased efficiency is obtained by raked blades. A plain oval blade is considerably easier to deal with, and will satisfactorily propel any model. High speed propellers usually have two blades, and the shape of these may be long for their width; lower speeds will be better suited by broader blades, or by three or four blades. Scale models should, of course, have an appropriate scale propeller. Liners generally have a streamlined extension of the propeller boss; cargo ships and tugs usually have a four-bladed propeller with a cylindrical boss.

The boss is turned, or cut from rod of appropriate size, and drilled through centre and tapped to screw on to the shaft. One end is marked with centre-lines, one, two or three, for two, four or three blades. From the ends of these lines, further lines are scribed along the sides of the boss, at the angle which our diagram has given for the blade at the boss radius. Slots are then cut in the sides of the boss along these lines; these slots are of such a width that the blades will be a tight fit in them. An "Eclipse" 4S slotting tool is the best means of cutting these slots; failing this a hacksaw with two blades fitted side by side may be used, or a single hacksaw cut be opened up with a thin file.

The blades are now cut from sheet metal, of appropriate thickness. They will probably be from $\frac{1}{16}$ in. to $\frac{1}{8}$ in. according to the size and duty of the propeller. They should be cut roughly to shape, clamped together and filed to final outline all at once, so that they are all the same size and shape.

The blades should be pressed or tapped into the slots, and the propeller rotated to check that all blades line up correctly. They may then be soldered in place. Silver solder is best for this job; but soft-soldered propellers, if carefully made, will function very satisfactorily for prototype models.

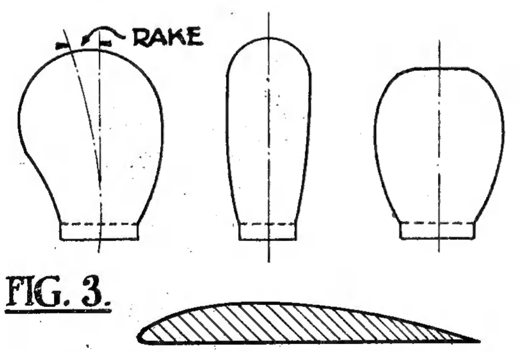
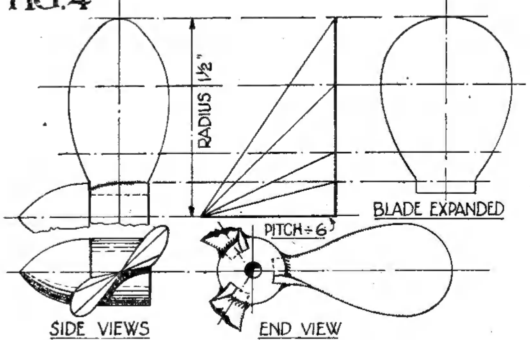


FIG. 3.

BLADE SHAPES AND SECTION.

FIG. 4



THREE BLADE PROPELLER. 3 in. DIA × 6 in. PITCH

Type of Model	Length of Model	Power Plant	No. of Blades	Dia. in.	Pitch in.
Launch	Up to 24 in.	Electric Motor	2	1½	1½
	„ 36 „	Electric Motor	2	2	3
	„ 36 „	2 c.c. Petrol or Diesel	2	2	3
Cargo ship ..	„ 36 „	Electric Motor	4	2	2
	„ 48 „	Electric Motor	4	3	3
	„ 36 „	Steam	4	2	3
	„ 48 „	Steam	4	3	4
Tug	„ 24 „	Electric geared 2 : 1	3	2	2
	„ 36 „	Electric geared 3 : 1	3	3	3
	„ 36 „	Steam	3	3	4
	„ 48 „	Steam	3	4	6

Fig. 2 shows these successive stages in the making of a two-bladed propeller. The next step is to file the back of each blade to a suitable section; what the aero-modellers call a " Clarke Y " is an excellent marine propeller section. It is flat on the under or striking face, and curved on the back, the maximum thickness being 1/3 back from the leading edge. Fig. 3 shows this section.

The blades now require twisting so that they take up the appropriate angles at various points along their length to give uniform pitch throughout. This twisting is done as follows:

Grip the tip of one blade between two pieces of hard wood in a vice, to a depth of about ⅛ in. Screw a temporary short shaft into the boss, and using this as a lever, twist until the angle between shaft and tip, looking vertically from above, is the same as the tip angle given by the pitch/radius diagram. A cardboard template of the angle may be used to check this. If the angles at boss and tip are reasonably correct, the intermediate parts of the blade will not be far out. The twisting is repeated in exactly the same manner for the other blade or blades; care should be taken to twist all blades as nearly as possible alike.

The propeller should now be polished all over, with fine emery cloth and finally with metal polish. If it is desired to cover completely the soldered joints, it may be copper plated and polished again; its appearance will then resemble that of a one-piece bronze propeller.

When a streamlined cap is fitted, this may itself be used as a lock-nut. It may have a hole drilled in it to take a tommy bar for tightening. If desired, the propeller may be fixed on to the shaft by a set-screw, but a screwed shaft and lock-nut are usually a more satisfactory fixing.

Fig. 4 gives the necessary data for a 3-in. diameter × 6 in. pitch three blade propeller. Fig. 1, of course, is equally applicable to a four-bladed propeller, if two additional slots are cut in the boss.

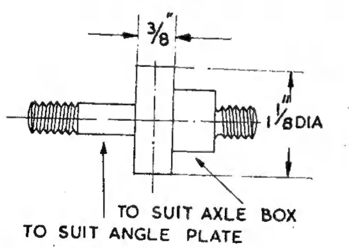
The table above gives suggested propellers for ship models of various sizes and types, but these are suggestions only. Trial and—not necessarily error; let us say rather, experience—are the most effective means of finding out the best propeller for any given model; " it's lots of fun finding out ! "

MACHINING MODEL LOCOMOTIVE AXLEBOXES

By J. O. S. Miller (New Zealand)

ASSUMING that the horn stays have been machined square and true in the frames and accurately spaced, it becomes most important that the axleboxes have the axle holes correctly located, i.e., exactly between the sliding faces.

The following is a very quick



way of producing axleboxes with the bores accurately spaced.

(i) Machine axleboxes all over to finished sizes except for the sliding faces, which should be left oversize.

(ii) Using ordinary marking-out methods to locate the centres of the holes—drill, bore and ream.

(iii) Make up a mandrel, as shown in the sketch, a good push fit to the bores, and attach to angle plate on shaper table, as shown in photograph.

To machine the sliding faces to finished sizes:—

(i) Push axlebox on mandrel and locate in horizontal plane with the aid of a " Starret Adjustable Parallel." Fit nut and washer and tighten up.

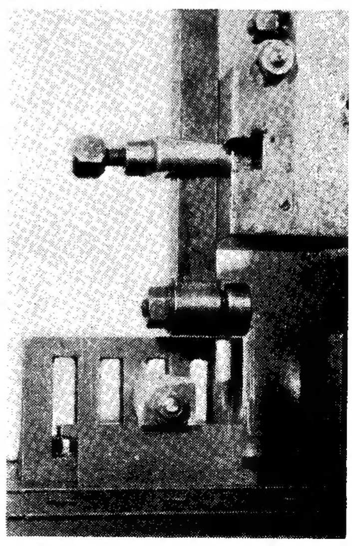
(ii) Take light cut over sliding face of axlebox.

(iii) Loosen nut, remove parallel and turn axlebox through 180 deg., adjust parallel under machined face, tighten nut, etc.

(iv) Take a cut at same setting of the shaper vertical slide.

The bore must now be equidistant between the sliding faces.

(v) To bring to finished size, " mike " carefully, put feed on shaper slide, equal to half the amount to be removed, and *repeat* the process.



QUERIES AND REPLIES

" THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with :

(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked " Query " and be addressed to THE MODEL ENGINEER, 19-20 Noel Street, London, W.1.

Ships' Plans, and Radio Control

I have recently acquired a partly finished hull of a Javelin *class destroyer and am anxious to complete it. I understand that details were published in* THE MODEL ENGINEER, *and I very much want to purchase the appropriate numbers if they are available. I am also wondering if you publish drawings of this destroyer.*

One further favour—I wish to purchase some books on radio control for models, and would be much obliged to receive the names of those you consider applicable.

C. de Vere Green. (London, W.1.)

The issues of THE MODEL ENGINEER in which the articles on the *Javelin* appeared are now out of print, but we embodied the drawings in the set of two sheets which you will find mentioned under reference P.B.13 in our Maritime Plans list, which may be had free on application. I think these would meet your requirements.

So far as we are aware, there are no books on radio control as applied to boats, but we have published a number of articles on the subject in our magazine, *Model Ships and Power Boats*, as follows :

" The Radio Control of Boats, " by F. C. Judd, October 1951 to March 1952.

" Building an Algerine Class Radio Controlled Model Minesweeper," by G. C. Chapman, April to July, 1952.

" Fun and Games with Radio Control," by C. F. Compton, August to September, 1952.

" Practical Radio Control," by R. F. Stock, November, 1952 . . .

" Radio Controlled Model Yacht Racing," by Lt.-Col. C. E. Bowden, December, 1952 to February, 1953.

The series by R. F. Stock is still running and there are others in preparation.

These would give you the latest information on the subject. We are preparing a book on the radio control of models, but we feel that articles in current magazines are more up to date and useful. The radio control of boats has immense possibilities and is developing very rapidly, and improvements are being introduced from day to day. Under these circumstances, magazine articles are the only way of keeping in touch with the latest developments.

Minimum Radius for Track

I am hoping to construct a 5-in. gauge model of a Whale *0-8-0 tender engine (ex-L.N.W.R.) and have got well on with the drawings. I have a plot of ground which will just take a roughly oval track but at one end, I find that one of the curves will have to be restricted to 42-ft. radius, compared with 50-ft. for all the other curves Will my proposed engine negotiate this short radius satisfactorily ? Is there a formula that will help me to solve my problem ?*

S.J.H. (Ruabon).

Taking your second question first, we do not know of any formula that we can recommend to you ; but there is a fairly well-known graphic method which has appeared in back volumes of THE MODEL ENGINEER more than once, and is fully set out in Greenly's book *Model Steam Locomotives*, obtainable from Greenly Models, 66, Heston Road, Hounslow, Middx, or from Cassell & Co., London, through any bookseller.

However, the generally-accepted minimum radius for 5-in. gauge is 30-ft.; so your engine should not have any difficulty in negotiating 42-ft. If you are unable to provide even a slight sideplay to either or both of the leading and trailing axles, we suggest that thinning of the flanges (or even removing them entirely) for the two pairs of intermediate wheels would prevent any trouble whatever. The thinning should, of course, be done on the inside faces.

Model G.W.R. " Bulldog "

I have sketched out a general arrangement for a G.W.R. " Bulldog " class 4-4-0 engine for 3½-in. gauge, but I find that the only suitable cylinders on the market have the valves on top and will, therefore, need a Joy valve-gear instead of the Stephenson gear. Will you please let me have a sketch of a Joy gear to suit this engine, bearing in mind that I do not wish my boiler, which is externally exactly to scale, to be more than the proper scale height above rail level.

A.J. (Patney, Som.).

We see no reason why you should jump to the conclusion that only a Joy gear will meet your requirements. Since your boiler and frames, wheels, etc., are completed, according to your original letter, you are obviously a model maker of some experience and ability, and we make the following suggestion for your consideration.

Machine your cylinders so that the port-faces are inclined to the centre-line of the cylinder bores, in elevation. The angle of inclination must be settled from your g.a. drawing ; but the centre-lines of the piston-rods and valve-rods should both cut the longitudinal centre-line of the driving axle. You could then mount the cylinders with the valve-chest either above or below, as you like; but in either case, you could easily work out a layout for the Stephenson gear without involving the use of any rocking-shafts or other impedimenta.

We make this suggestion and ask you to give it your earnest consideration, because the idea of a G.W.R. " Bulldog " with any other valve-gear than the Stephenson is abhorrent to us. The phenomenal success of these engines was largely due to that Stephenson gear, with its 5½-in. valve-travel in full gear.

Cine Projector Details

Will you please advise me on the following details with reference to the " M.E." home cine projector :

(1) *What is the correct speed of the flywheel shaft of the projector, and how can this speed be definitely assured when driving the projector with a fractional h.p. motor ?*

(2) *What is the reason for the film, although arranged in a loop above and below the gate when the machine is started, gradually pulling the loop tighter at the top until it is hard against the gate ?*

(3) *The projector appears to produce a slight flicker, and I should be glad to know how this could be eliminated.*

A.H.D. (London, S.E.14.)

(1) The correct speed of a projector for standard silent films is 16 frames per second, which in the case of the projector in question

means 960 r.p.m. of the flywheel. This speed is often varied to suit the preference or the convenience of the user, but it is more common to run the motor, if anything, faster than the theoretically correct speed. If it is run at a speed of much less than 16 frames per second, there is a tendency for the movement to appear very jerky, and this also tends to increase the flicker. It is always very difficult to get small motors of any type to run at a definite speed, as universal motors have a variable load/speed characteristic, and the amount of slip varies in the case of induction motors. The best method to obtain the right speed in your particular case is to make some experiments in the sizes of the flywheel and motor pulley.

(2) The reason why the loop of the film is drawn tight is because, for some reason or other, the claw is pulling the film through the gate at a faster rate than the top sprocket. This is usually because of missing or faulty perforations. In some cases the take-up spool may tend to drag the film through faster than it is fed by the sprocket, but if both sprockets are in proper engagement, the size of the loop should remain constant.

(3) With the type of shutter used in this particular machine, the triple blade recommended gives the best results which can be obtained, except by using over-geared shutters. It is, however, important that the shutter should be accurately timed so that the film movement takes place while the larger section of the shutter blanks out the picture.

Material for Bushes

I shall be grateful if you would advise me regarding the most suitable materials from which to make small bushes, say up to $\frac{3}{16}$ in. bore, for restoring worn pivot holes in horological and similar work. I understand the use of brass for bushes is not recommended, and the merits of alternatives, such as gunmetal, aluminium, bronze and duralumin may be considered. Phosphor-bronze is difficult to work.

W.G.M. (Belfast).

The use of hard brass is practicable in cases where the speed is low, as in clocks and certain other types of instruments, but the coefficient of friction of this material, unless specially made for the purpose, is higher than that of metals such as bronzes. Drawn bronze was formerly obtainable in rods or bushings known as "Bouchons," but if this material is not available, it might be possible to get small sticks of gunmetal cast by a local foundry.

WITH THE CLUBS

The Derby Society of Model and Experimental Engineers

Recently, a party of 25, comprising members and their families or friends, visited the Birmingham Society's track at Campbell Green. We were warmly welcomed by their honorary secretary, Mr. R. Phillips, and introduced to a number of their members who were most kindly engaged in getting steam up on their locomotives on our behalf. We were particularly impressed by their kindness in devoting a further Saturday afternoon for our pleasure and "the good of the cause." Five locomotives were soon in steam and showing off their paces; these were: one L.N.E.R. *Bantam Cock* 2-6-2, $3\frac{1}{2}$-in. gauge, one G.N.R. Atlantic 4-4-2, 5-in. gauge, one free-lance 2-6-4T, $3\frac{1}{2}$-in. gauge, one L.M.S. 2-6-0, $3\frac{1}{2}$-in. gauge and one free-lance 0-4-0T., 5-in. gauge.

We lament the loss of several members who have left the town, but have been happy in welcoming new members and would be glad to welcome more. Our club rooms at 294, Abbey Street, are now redecorated and work has started on the workshop. We suggest that some of the old members we have not seen for some time should "pop in" one Wednesday evening if only for "auld lang syne."

Hon. Secretary: G. T. SMITH, 52, Holtlands Drive, Alvaston, Derby.

Rednal and District Society of Model Engineers

Recently, the above society held its annual general meeting at The Institute, Northfield. The secretary stated that during the past year, quite a number of visits had been made to various places of interest, the most outstanding being the one on the occasion of the club's outing to THE MODEL ENGINEER Exhibition, last October.

On June 28th last, the portable track was in operation at the Kalamazoo Sports, and also at Rubery on July 5th. The club's funds benefited by these fixtures.

The portable track of 108 ft. is now erected on a permanent site at Barnt Green, and further extensions are to be carried out forthwith.

New members will be most welcome and are requested to get into touch with the Secretary, MR. TARRANT, 38, Middle Drive, Rednal. Meetings are held every other Friday at The Institute, Northfield, from 7.30 to 10 p.m.

Greenwich and District Ship Model Society

The society's syllabus for the first quarter of 1953 is as follows:—

Meetings are held every Friday at Charlton House, Charlton Village, S.E.7, commencing at 8 p.m.

March 6th, "Building a Model of the *Massey Shaw*," Mr. J. S. Baines; April 3rd, "A Model of the *Archibald Russell* and where I Went Wrong," Mr. A. Cassell; May 1st, "Paints and Painting," Mr. E. Paling.

Hon. Secretary: J. B. JENKINSON, 47, Harvey Gardens, Charlton, S.E.9.

Blackpool Society of Model Engineers

This notice is to let the rest of the modelling public know that the society in Blackpool is very much alive. We have had great difficulty in obtaining a suitable meeting room, but have eventually managed to get fixed up, and now meet every Wednesday at 7.30 p.m. at the "Marton Working Men's Club and Institute" at the Oxford roundabout, Marton.

We have building at the moment as follows:—Two *Doris* ("M.E."), one "Royal Scot," $3\frac{1}{2}$-in., one B.R. Class 5, $2\frac{1}{2}$-in., one L.Y.R. 4-4-2, 5-in., a gauge "O" layout, $1\frac{1}{2}$-in. scale "Big Lion" traction engine, prototype cabin cruiser, and a large French steam tug which is to be powered by the engine which won the premier award at Bolton two years ago.

Hon. Secretary: A. N. STOKES, 58, Blackpool Road, Bispham, Blackpool.

Aylesbury and District Society of Model Engineers

The annual general meeting came round again recently. Many of the old faces will be back in office, with Mr. R. Eborn still in the presidential chair. Members and friends will be pleased to know that Mr. H. East has been appointed a vice-president, a small tribute for his unfailing service. His fellow vice-presidents are Mr. Forest and Mr. Cleaver.

In his absence through illness, Mr. Forest was re-elected as chairman, while Mr. Hasberry continues as vice-chairman. Mr. Smith will again take up the secretary's pen, while keeping his other hand on the treasury box. No new faces are to be seen among the members elected to committee, their names being Mr. Darton, Mr. Gill, Mr.